

**TEAM TASK MANAGEMENT:  
THE IMPACT OF SOCIAL AND TECHNOLOGICAL FACTORS ON  
TASK MANAGEMENT BEHAVIOR**

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Joseph D. McDonald, M.S.

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# **TEAM TASK MANAGEMENT: THE IMPACT OF SOCIAL AND TECHNOLOGICAL FACTORS ON TASK MANAGEMENT BEHAVIOR**

Approved by:

Dr. Leslie A. DeChurch, Advisor  
School of Psychology  
*Georgia Institute of Technology*

Dr. Wendy A. Rogers  
School of Psychology  
*Georgia Institute of Technology*

Dr. Francis T. Durso, Advisor  
School of Psychology  
*Georgia Institute of Technology*

Dr. Jessica R. Mesmer-Magnus  
School of Business  
*University of North Carolina  
Wilmington*

Dr. Rick P. Thomas  
School of Psychology  
*Georgia Institute of Technology*

Date Approved: November 14, 2016

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## LIST OF SYMBOLS AND ABBREVIATIONS

$\alpha$	Alpha level at which statistical significance is achieved
ANOVA	Analysis of variance statistic used to determine statistical differences across experimental groups
BIC	Bayes Information Criterion used to determine fit of mathematical models to observed data
BF	Bayes Factor used to express the relative fit of two models as an odds ratio
$\Delta$ BIC	Change in Bayes Information Criterion used to determine the relative fit of two models
$e$	Exponential
EW	Equal Weight decision strategy
$F$	F statistic used to determine statistical significance in the Analysis of Variance parametric test for significance
$f$	Cohen's $f$ standardized measure of effect size
ln	Natural Log
$M$	Mean
$N$	Number of participants in the sample
$n$	Number of participants in the experimental group
$p$	Pearson
$Q$	Q statistic used to determine statistical significance in the Friedman non-parametric test for significance
$r$	Pearson's correlation coefficient
$r^2$	Coefficient of determination
$SD$	Standard deviation
SMM	Team Shared Mental Model
TTB	Take-The-Best decision heuristic

$\chi^2$  Chi-squared statistic used to determine statistical differences across experimental groups

## SUMMARY

In modern-day workplaces, knowledge workers are given more freedom than ever to choose which tasks to work on as well as how those tasks will be carried out. These choices include not only characteristics of the tasks themselves, but also a consideration of which team they will work with to accomplish the task (i.e., team factors), and the technology platforms that will be used to collaborate (i.e., technological factors). Despite the marked shift toward digitally supported team-based collaboration, research on task management focuses primarily on characteristics of tasks such as difficulty, salience, and meaningfulness (e.g., Wickens, Santamaria, & Sebok, 2013). This dissertation extends the task management literature to understand the relative impact of social and technological factors on task management. I present findings from two studies of team task management, defined as managing multiple tasks for which multiple teams are responsible. Study 1 utilized Policy Capture methodology to uncover the relative impact of three team factors: cohesion, cognition, and coordination, on individuals' attraction to work on the team. Findings across multiple analytical approaches (i.e., multiple regression, cluster analysis, and Bayesian modeling) show team factors affect individuals' attraction to a team task, and that cohesion is the most important aspect of the team, followed by cognition, and least important is coordination. These results offer robust support for the effect of team cohesion (and other team factors to a lesser degree) on Team Task Management decisions. Study 2 manipulated the most important team factor from Study 1, cohesion, along with a technological affordance, permanence, to understand their impact on task management behavior. Results of Study 2 did not reveal significant relations between team or technology factors on task management behavior. Thus, results from Study 2 indicate that team cohesion does not affect

Team Task Management decisions when teams are working virtually using basic synchronous communication and chat function tools. Results showed no main effect of cohesion on time spent on teams in this basic-functionality virtual environment, nor any effect of the technology manipulation (i.e., chat function present versus simple synchronous communication within the shared document). Although restricting the collaboration tools was a necessary first step to understanding how individuals manage team tasks in a virtual environment, providing individuals with more information-rich tools (e.g., video conferencing) that provide additional cues to the level of cohesion on a team (e.g., non-verbal communication) could have possibly led to results similar to those seen in Study 1. Therefore, the results of Study 2 may not generalize to face-to-face teams or those using more information-rich forms of virtual collaboration (e.g., Kirkman & Mathieu, 2005). Furthermore, in Study 2, confederates served as team members who communicated statements indicative of a high or low cohesion team. Cohesion may not have affected task switching behavior in this study because of this operationalization, and its inability to adequately capture the construct of team cohesion as it is experienced in real teams. One finding from Study 2 that informs our understanding of team task management in basic synchronous communication virtual environments is that individuals are more likely to work with teams in general than on individual tasks. Taken together, the studies in this dissertation extend basic research on task management in overloaded environments to include social and technological aspects of work tasks. One practical implication of this program of research is that investing in cohesion-building strategies for teams operating in face-to-face environments can help ensure that team members plan to allocate adequate time to critical team tasks. Second, individuals switching between both individual and team tasks in a basic synchronous collaboration virtual environment are likely to spend significantly more time on

team rather than individual tasks, so assigning (only) important tasks to teams will help ensure the completion of those tasks.

## CHAPTER 1. INTRODUCTION

In modern-day business and academic environments, knowledge workers are given more freedom than ever to choose which tasks to work on as well as how those tasks will be carried out. These choices include not only characteristics of the tasks themselves, but also a consideration of which team they will work with to accomplish the task (if any), and the technology platform that will be used. These decision criteria are becoming increasingly important as more and more companies adopt team-based work systems (e.g., Lu, Wynn, Chudoba, & Watson-Manheim, 2003; Mortensen, Woolley, & O’Leary, 2007; Zika-Viktorsson, Sundström, & Engwall, 2006) and the micronization of computing technologies afford individuals an enormous range of technologies with which to collaborate (e.g., Jaspersen, Carter, & Zmud, 2005). Despite these shifts in the nature of work, research on task management focuses primarily on characteristics of tasks such as difficulty, salience, and meaningfulness (e.g., Wickens, Santamaria, & Sebok, 2013). This dissertation extends the task management literature to include social and technological factors prevalent in modern-day work environments.

*The central thesis of this dissertation is that teams and technologies influence how individuals manage tasks throughout a workday, and certain characteristics of teams and technologies influence task management more than others.*

When tasks require interdependence among individuals, task management may be affected by social factors - unique, distinguishing features of teams. There are generally

thought to be three broad categories of team characteristics: affective states, behavioral processes, and cognitive states. Teams can differ based on how the members feel about the team (i.e., team affect), how members interact to achieve goals (i.e., team behavioral processes), and the degree to which team members share a similar understanding of the task and team (i.e., team cognition).

When tasks are performed using technologies, technological factors may affect task management. Technological factors are affordances that enable employees to carry out teamwork in ways that are consistent with their personal work style. Specifically, collaboration tools can provide employees the ability to edit work products before making them visible to the team, store information related to team products, process, communications, and member attributes, and create a representation of team member relationships that is consistent with their personal mental model.

## **1.1 Social Factors and Task Management**

In order to see how social factors may affect task management, consider the following vignette:

*Tom was a business intelligence analyst for a large technology company. While working with a sales team on a project to convert more marketing leads to sales, Tom was approached by a marketing team member to join their efforts to create a new integrated approach to direct marketing. Tom had worked with the marketing team in the past and the experience was a very positive one. All team members believed in the collective goal that they set out to achieve, welcomed new ideas from members, and discussed any disagreements in constructive ways. They could*



*rely on each other to pull their weight on the task at hand and were willing to step in and take on more work if a member had to step away for personal reasons. They operated well under tight deadlines as all members seemed to be “on the same page” with where they were in the marketing campaign delivery process, and could anticipate each other’s actions. Tom found these qualities of the marketing team incredibly attractive as compared to the sales team. In the sales team, social interactions typically led to conflicts, personal attacks, or criticisms of one’s values. Furthermore, Tom’s impatience with the sales team was building as the team had to repeatedly meet to discuss the “big picture” because members seemed to focus entirely on their own sales initiatives while ignoring the team goal. Over time, Tom found himself working more and more with the marketing team, and less with the sales team.*

As this vignette illustrates, the social context of the team could exert a powerful effect on the individual when choosing which tasks to work on. In fact, from a team perspective, it begs the question of whether the individual chooses the task or the team. Teams are defined as “(a) two or more individuals who (b) socially interact (face-to-face or, increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks, exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment” (Kozlowski & Ilgen, 2006, p. 79). Because of the increasing specialization of knowledge work, many important organizational and academic tasks require teamwork.

Teams can be described as having their own entitativity (Castano et al., 2002), or “the extent to which a group is perceived as having real existence, as being a real entity” (p. 136). Team entitativity comprises properties of a team such as “internal homogeneity, social interaction, clear internal structure, common goals, and common fate” (Hogg, Sherman, Dierselhuis, Maitner, & Moffitt, 2007, p. 136). The social force created by the nucleation of a particular team comprises an important set of social factors that drive task management decisions. Thus, my first research question is: “*Which team characteristics affect an individual’s task management?*” To answer this question, I turn to the team effectiveness literature that identifies three types of characteristics on which teams can be described and distinguished: 1) team affective states (e.g., team cohesion), 2) team behavioral processes (e.g., team coordination), and 3) team cognitive states (e.g., team shared mental models) (e.g., Kozlowski & Ilgen, 2006).

### *1.1.1 Task Management*

Task management describes how individuals make decisions about which tasks they will execute and when in a sequential multitasking scenario (Wickens, Gutzwiller, & Santamaria, 2015). Two essential components of task management are individuals’ tendency to remain on their current task and their attraction to other tasks. With regards to a current task, there is a natural propensity to continue doing what one is already doing. Described as task inertia, there is a state of flow that generally sets in when individuals engage in a task (e.g., Csikszentmihalyi, 1991), and, consequently, there are switching costs to changing tasks. The sum of these inertial forces acting upon the individual to remain on a given task has been described as “task stickiness” (Wickens et al., 2015). Of course, tasks vary on how much inertia is inherent in the task.

Tasks also differ in how “attractive” they are (Wickens et al., 2015). A task’s “attractiveness” is defined as all attributes of a task that increase the likelihood that someone will switch to that task given the opportunity (Wickens et al., 2015). Some tasks are interesting, fun, engaging and therefore tempting to the individual to switch to despite the associated switch costs (e.g., searching the internet). Other tasks are boring, repetitive, and time consuming, and therefore repulsive in nature (e.g., responding to emails). Whereas the task management literature has well considered the different characteristics of tasks that make them differentially sticky and/or attractive, I posit that on team tasks, there are social factors associated with the properties of the team that determine the degree to which a team task is sticky and/or attractive.

### *1.1.2 Team Task Management Definitions*

Extending the notion of stickiness and attractiveness to the case of team tasks, I define team task stickiness and attractiveness, and study their constituent parts. Team task stickiness can be defined as all characteristics of a *team* that increase the likelihood that a member of the team will continue to work on that team’s tasks when alternative tasks become available. Similarly, team task attractiveness can be defined as all characteristics of a *team* that increase the likelihood that an individual will switch away from their current task to work on that team’s task. In this dissertation, I investigated core aspects of team emotional states, behavioral interaction processes, and team cognitive states as constituent elements of team task stickiness and attractiveness. To capture the team context in which individuals manage their tasks, I will refer to tasks completed with teams as “team tasks” and the management of multiple team tasks as “team task management.”

### 1.1.3 Team Factors of Team Task Management

The first constituent of team task stickiness and attractiveness is team affect. *Team affect* is an emergent property of a team that characterizes how members feel about the team. Affective states are qualities of a team, such as a collective belief that the team can accomplish what they set out to achieve and a shared motivation to perform well (i.e., collective efficacy; Chen & Kanfer, 2006). Affective states predict the likelihood that individual members will remain on the team (Mullen & Cooper, 1994), and the performance of the team as a whole (Levine & Moreland, 1990). Teams in which members share strong emotional and social relationships fulfill each member's basic emotional need to bond (e.g., Nohria, Groysberg, & Lee, 2008), and foster a *desire* to contribute to the team's ability to continue as a functioning work unit. The quintessential affective state is team cohesion. Festinger (1950) described cohesion as "the resultant of all the forces acting on the members to remain in the group" (p. 274). He describes three facets of team cohesion: (1) the emotional and social bonds that link team members to the team as a whole, (2) a sense of pride in the team, and (3) a commitment to team tasks. Teams that demonstrate these three facets are more likely to "stick together" and remain united while striving towards common goals (Carron, 1982). Team cohesion provides a rich collective climate (e.g., Lewin, Lippitt, & White, 1939) in which members experience constructive social interactions, share unique perspectives, and engage in collective problem solving and decision making, resulting in higher team performance (e.g., Mullen & Cooper, 1994).

I propose that team affect has different effects on team task attractiveness and team task stickiness. Specifically, team affect (i.e., cohesion) is positively related to team

task stickiness because the more cohesive the team, the more likely team members are to contribute a greater percentage of their time to the team tasks (e.g., Meyer & Herscovitch, 2001). This is because members of cohesive teams have established strong emotional and social ties with their teammates resulting in a strong sense of pride and affective commitment to the team's success (Festinger, 1950). Members with affective commitment (Meyer & Allen, 1991) to teams are more likely to forego self-interests in favor of collective interests (e.g., Wit & Wilke, 1992) and are more likely to strive towards team goals in the face of opposing forces (e.g., Scholl, 1981).

*Hypothesis 1. Team cohesion is positively related to team task stickiness.*

I propose a more complex relation between team cohesion and team task attractiveness. It is important to consider that employees are often members of multiple teams at any given time (e.g., Mortensen et al., 2007), and each of these teams requires commitments from team members to fulfill their team responsibilities. Therefore, it may be in an employee's best interest to defer switching to a highly cohesive team while working on a project with another team because the probability that they will return to the current team's task may be low. This is because highly cohesive team members rarely branch out and seek other interests or accomplish tasks that are not "team-related" (Crawford & LePine, 2013). Generally speaking, a member of a highly cohesive team may view this lack of individual agency as unattractive. On the other hand, teams with very low cohesion are too scattered to accomplish their goals (Crawford & LePine, 2013), making such teams unattractive as well. Therefore, teams with a moderate level of

cohesion may be preferable as these teams can effectively work together to accomplish a task while allowing members to more easily break away from team tasks to attend to other responsibilities.

*Hypothesis 2. Team cohesion has a curvilinear (i.e., “inverted-U”) relationship with team task attractiveness, such that low team affect is not attractive, moderate team affect is highly attractive, and high team affect is not attractive.*

The second constituent of team task stickiness and attractiveness is team behavioral process. *Team behavioral processes* are defined by Marks et al. (2001) as “members’ interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities ... [they] are the means by which members work interdependently to utilize various resources, such as expertise, equipment, and money, to yield meaningful outcomes” (p. 357). For example, teams may develop a distinct pattern of communication between members to efficiently share information across the team, or may demonstrate a propensity to “backup” other members who may temporarily step away from the task at hand. Teams can enact these distinct “patterned relations” (McGrath, 1997, p. 11) to varying degrees. For example, some teams may engage in “backup behavior” more than others (Marks, Mathieu, & Zaccaro, 2001). Establishing team behavioral processes that are compatible across the team can engender efficient and effective execution of tasks by team members, consequently increasing the ease with which teamwork is carried out. I propose that team members will find the team quality of

synchronized and compatible behavioral processes attractive, and they will be more likely to “stick” to such teams.

The idea that patterned behavioral processes, and team coordination process in particular (Marks et al., 2001), are “sticky” and “attractive” is supported by research on synchrony. Often referred to as a product of “social entrainment” (e.g., McGrath & Kelly, 1986; Ancona & Chong, 1992), synchrony describes how rhythmic patterns of one team behavioral process can come to match (or complement) the rhythm of another team behavioral process (e.g., Ancona & Chong, 1992). For example, team members may fall into a predictable pattern of a short planning period followed by a long period of carrying out the planned actions. Marks and colleagues (2001) describe such patterns as team coordination, which they define as “the process of orchestrating the sequence and timing of interdependent actions” (p. 363). Teams that are able to establish strong coordination reduce the overall efforts required by each member, are more efficient, and produce higher quality outputs than unsynchronized teams (e.g., Harrison, Mohammed, McGrath, Florey, & Vanderstoep, 2003), making them more “attractive.” With regards to team task “stickiness,” the persistence of team coordination patterns may further bind individuals to the team. This is because team member behavioral processes that characterize their coordinated efforts tend to continue at the pace and cycle with which they entrained to the team, even in the face of conflicting external demands. Research by Harrison and colleagues (2003) demonstrated that highly synchronized team coordination patterns persisted well beyond the onset of an interrupting task that required a different pace and cycle of coordination.

*Hypothesis 3. Team coordination is positively related to team task stickiness (H3a) and team task attractiveness (H3b).*

Finally, *team cognition* (specifically, the team shared mental models perspective of team cognition) describes the degree to which team members share a similar understanding of the task and team (e.g., DeChurch & Mesmer-Magnus, 2010). Teams with strong shared mental models are typically more efficient because “being on the same page” mitigates the need to constantly clarify one’s understanding of the situation. Because the team shares a similar mental model, each team member will assess the state of the team and task in a similar way, and will make similar predictions as to the actions that need to be taken at any particular point in the task. Therefore, remaining on a team with a strong mental model, or switching to a team with a strong mental model, is likely to be perceived as less effortful. This is because team members are able to rely on implicit coordination and do not need to communicate with one another to carry out the task (e.g., Cannon-Bowers & Salas, 2001), therefore reducing “coordination overhead” (Entin & Serfaty, 1999, p. 312). On the other hand, employees are likely to switch away from a team (or avoid switching to a team) that does not share common understanding of the situation due to the coordination efforts required to effectively execute the task at hand.

*Hypothesis 4. Team cognition is positively related to team task stickiness (H4a) and team task attractiveness (H4b).*



## 1.2 Social Factors and Task Management

In addition to social forces, technological factors may also generate forces that push and pull employees towards and away from tasks. For example, some collaboration technologies provide flexible functionalities that enable employees to carry out teamwork in ways that match their personal work style (e.g., Leonardi, 2011), thus increasing the ease with which team members can scaffold their ideas to their teammates'. The presence or absence of these affordances may drastically influence employee task management decisions. Specifically, technological affordances may moderate the “attractive” and “sticky” aspects of team tasks when individuals choose which tasks to work on with whom. Consider this vignette:

*Jennifer is a graduate research assistant in a wearable technology lab that values an interdisciplinary, team approach to project management. Although many collaboration technologies are available to employees, Jennifer has always used web-based spreadsheets applications to coordinate with team members and manage project deadlines in real-time. One afternoon, Jennifer received an email from a teammate requesting that she join their team's collaboration tool to develop a new interface for a smart watch. When she clicked on the link, she noticed that their tool had a built-in chat function that included previous conversations between team members. After spending five minutes scrolling through team member conversations, and reading multiple discouraging remarks, Jennifer got the feeling that this team was more concerned about making their own voices heard than striving towards a collective goal. Jennifer decided that working with a team that spent the majority of their time working through social*

*disagreements rather than focusing on the task at hand was not worth her time, and returned to her other team task without contributing to the second team's efforts. She noticed another email from a third team that was working on the same wearable technology. When she scrolled through this team's chats, she was pleasantly surprised by how supportive the team members were to one another and how dedicated they were to accomplishing their task, even if it meant temporarily putting off other things that came up. Over time, Jennifer became more invested in this third team's project. This surprised Jennifer because the wearable technology project wasn't something she had considered pursuing.*

### *1.2.1 Technology Affordances*

Although social forces of a team are likely to influence the stickiness and attractiveness of that team's tasks, the ease with which a collaborative technology conveys these social elements to team members, thereby facilitating effective teamwork and taskwork, may moderate these relationships. For instance, some collaboration tools provide easy access to records of team member communications, which allows individual team members the opportunity to develop a sense of the team's cohesiveness. Even though the collaboration tool's functionality may not have been designed for that particular purpose, these possibilities are *afforded* to team members as an artifact of how the technology is designed (e.g., reviewable records of team member communications).

Affordances are action possibilities available in one's environment (e.g., Norman, 2013). For example, a handle on a door provides someone the affordance of opening a door by pulling it inward. However, affordances may exist independent of one's ability to perceive them (e.g., Gibson, 1977). For example, a notepad has the obvious affordance of

recording notes, but may also serve as a bookmark to those who recognize this possibility. This second definition of affordances, which carries the implication that individuals use the functionality provided by collaboration tools for a variety of purposes despite the intended functionality of the tool, is often referred to as appropriation (e.g., DeSanctis & Poole, 1994; Poole & DeSanctis, 1989). Specifically, software collaboration tools can provide affordances that enable users to create a permanent record of team and task information that the individual finds meaningful (i.e., persistence affordance - the ability to retain information in the same form that it was entered; Treem & Leonardi, 2012) in the form in which they prefer to keep it (i.e., editability affordance - the ability to craft, review, and change communications before making them visible to others; Treem & Leonardi, 2012), and better represent task and team relationships in ways that are consistent with the individual's mental model (i.e., person-to-information association affordance - the ability to make visible established links between individuals; person-to-person association affordance - the ability to make visible established links between individuals and content; Treem and Leonardi, 2012). Because modern-day teams typically fall somewhere on the virtuality spectrum (e.g., Cohen & Gibson, 2003; Gibson & Gibbs, 2006), these affordances could directly impact the relationships between team task attractiveness/stickiness and the three defining characteristics of a team: 1) team cohesion, 2) team coordination, and 3) team shared mental models.

Importantly, there are many ways in which team virtuality can be described. Kirkman and Matthieu (2005) provide a taxonomy of team virtuality that varies across three dimensions: (1) "the extent to which team members use virtual tools to coordinate and execute team processes" (p. 700), (2) "the synchronicity of team member virtual

interactions” (p. 700), and (3) “the amount of information value provided by such tools” (p. 700). The technology affordances of interest to the current research program would likely rank highly on the first two dimensions, but would not necessarily be considered “information-rich” on the third dimension. Thus, the specific qualities of virtual collaboration (according to Kirkman and Matthieu’s taxonomy) being discussed here are the extent to which members use the virtual tools (i.e., exclusively in the current research) and the synchronicity of communication (i.e., completely synchronous in the current research), but not a high level of information value that characterizes other collaboration tools (e.g., video conferencing). Furthermore, a second taxonomy of team virtuality proposed by Gibson and Gibbs (2006) addresses a number of factors that are tangentially related to virtual communication: (1) geographic dispersion, (2) electronic dependence, (3) structural dynamism, and (4) national diversity. Although the use of virtual collaboration tools can afford individuals the ability to team-up with global teams who may be more regionally and nationally diverse than would otherwise be possible, can lead to a higher dependence on electronic communication, and can shape the structural dynamics of otherwise intact teams towards more fluid boundaries, these byproducts of virtual teams are not considered in the current research. What is of interest is the general nature in which technology-mediated collaboration can change the way team processes are carried out, which may inform the influence of technology affordances on the way in which teams are perceived in a virtual environment. For example, Mesmer-Magnus and colleagues (2011) demonstrate that team members collaborating virtually share more unique information, in general, than teams interacting face-to-face.

### *1.2.2 Technological Factors of Team Task Management*

The technology affordance of persistent person-to-person association allows individuals to make visible relationships that they may share with other employees (i.e., their “social ties”). For example, employees can “tag” a colleague on a joint project or create a team page on Basecamp, and these relationships will be displayed on their collaboration tool (e.g., Chen, Geyer, Dugan, Muller, & Guy, 2009). This lasting visual representation is likely to make one’s social relationships with colleagues more salient to the employee, and is likely to strengthen the representations of these relationships in one’s memory as the permanent record is revisited over time. This is important because such affordances do not simply display relationship ties, but afford the user the ability to represent the affective aspects of the relationships in various ways in a permanent manner. Indeed, researchers who have analyzed social media sites have successfully distinguished between professional and personal closeness that users of the technology share with co-workers (e.g., Steinfield, DiMicco, Ellison, & Lampe, 2009; Wu, DiMicco, & Millen, 2010). Therefore, I propose that the positive relationship between team task stickiness and team cohesion (H1) will be significantly stronger when persistent person-to-person affordances are available because they will augment the affective forces (e.g., cohesion) that bind a team together.

With regards to team task attractiveness, persistent person-to-person association affordances may change the proposed relationship between team affective states and team attractiveness (H2). Specifically, these affordances may help to break down the seemingly impenetrable barrier that surrounds highly cohesive teams, allowing team members to more easily bond with others outside of their team. Collaboration tools

streamline the ability to connect with employees across one's teams (e.g., to ask a work-related question), and that initial connection often leads to a deeper relationship without much additional effort. For example, research on social media use in organizations shows that initial interactions with employees over these platforms lead to the development of relationships beyond the intent of the interaction (e.g., Farzan, DiMicco, & Brownholtz, 2009). Furthermore, many collaboration platforms *engender* connections with other employees across an organization (e.g., Zhang, Qu, Cody, & Wu, 2010; Ehrlich & Shami, 2010), thus fostering behavior that allows members of highly cohesive teams to break out of their completely team-focused behaviors. The ease with which employees expand their social relationships via collaboration technologies is also supported by multiple findings on the positive relationship between persistent person-to-person association affordances and social capital (e.g., Ellison, Steinfield, & Lampe, 2007; Ferron, Frassoni, Massa, Napolitano, & Setti, 2010).

*Hypothesis 5. Persistent person-to-person association affordances strengthen the relationship between team cohesion and team stickiness (H5a), and change the relationship between team cohesion and team attractiveness from a curvilinear (i.e., “inverted-U”) function to a positive relationship (H5b).*

The technology affordance of editability enables employees to craft, review, and change communications before making them visible to others (Treem & Leonardi, 2012). Because employees are able to use such technologies in ways that align with their personal work style, I propose that editability affordances will strengthen the positive

relationship between team behavioral processes and team stickiness and attractiveness. This is because individuals will be more likely to remain engaged with a team in which they can effectively produce outcomes with the team. Furthermore, they will be able to more easily contribute to a new team in meaningful ways, which increases the attractiveness of that team's task.

*Hypothesis 6. Editability affordances strengthen the positive relationship between team coordination and team task stickiness (H6a) and team task attractiveness (H6b).*

The technology affordances of person-to-information association (i.e., the ability to make visible established links between individuals and the information they share; Treem & Leonardi, 2012) enable employees to make visible the connections between team member knowledge and the task environment. In this way, not only do these affordances augment team members' mental models of team and task connections, they also create a shared platform that all team members can reference to remain "on the same page."

*Hypothesis 7. Person-to-information association affordances strengthen the positive relationship between team cognition and team shared mental models (H7a) and team task attractiveness (H7b).*

My dissertation comprised two studies designed to identify the most important social and technological factors involved in individuals' decisions to remain on a current team task or switch to an alternative team task. Because there are a great a number of team factors that can influence team task management, this two-study approach enabled me to distill the team factors down to a manageable number (Study 1) before I conducted a behavioral analysis of the relationships between team factors, collaboration technologies, and team task management decisions (Study 2).



## **CHAPTER 2. STUDY 1: IMPACT OF SOCIAL FACTORS ON TASK STICKINESS & ATTRACTIVENESS: A POLICY- CAPTURING APPROACH**

Policy capturing is a technique used to extract generalizable “rules” that individuals use to make decisions. This approach differs from traditional survey techniques that simply ask participants to report why they made certain choices, because in policy capturing, “... the importance of the factors affecting a decision is *inferred* from actual responses to scenarios” (Webster & Trevino, 1995, p. 1546). Policy capturing has been used to identify reliable, generalizable “decision rules” in a variety of business application areas, ranging from personnel selection (e.g., Klaas & Wheeler, 1990), finance (e.g., Slovic, 1972), and marketing (e.g., Batsell & Lodish, 1981), to basic research on judgment and decision making (e.g., Brehmer & Brehmer, 1988; Cooksy, 1996; Stewart, 1988) in cognitive psychology. In this dissertation, I used the policy capturing technique to determine which social factors of teams in particular significantly influenced participants’ judgments about how attractive teams are, ultimately leading to their choices to work on some teams and not others.

### **2.1 Selected Social Factors Influencing Task Management Decisions**

The selected team factors of interest [selected from McDonald et al.’s (2015) taxonomy of team task management factors] were team cohesion (i.e., the team operates in unity and works towards a common team goal; Mullen & Cooper, 1994), team coordination (i.e., patterned actions carried out by the team; Marks, Mathieu, & Zaccaro, 2001), and team shared mental models (i.e., a shared understanding among members that develops over time; Cannon-Bowers & Salas, 1990; Cooke, Gorman, Duran, & Taylor,

2007; DeChurch & Mesmer-Magnus, 2010). The levels of each of these factors varied across scenarios, and were specified as follows: (1) team cohesion (low, moderate, and high), (2) team process (low, moderate, high), and (3) shared mental models (low, moderate, high). For example, a team that was high on each of the social variables was described as follows:

*“The team provides a safe, comfortable environment to openly share ideas.”*

[Team cohesion = high]

*“Team member actions are tightly synchronized with the other members of their team.”* [Team coordination = high]

*“Team members are always ‘on the same page’ when asked about aspects of the task or how it is being carried out.”* [Team shared mental models = high]

In order to select the most appropriate descriptions of each of the team characteristics, I conducted a content validity study to ensure that all descriptions were valid representations of the team factors, and that participants could reliably distinguish between the different levels of these team factors. See Table 1 for the team descriptions that passed the content validity test and were used in the policy capturing study.

**Table 1 – Team descriptions that passed the content validity test and were used in the policy capturing study**

<u>Team Factor</u>	<u>Team Description</u>
Coordination - High	Team member actions are tightly synchronized with the other members of their team.
Coordination - Moderate	Team member actions are sometimes synchronized and sometimes out of sync with the other members of their team.
Coordination - Low	Team member actions are rarely synchronized with the other members of their team.
Shared Mental Models - High	Team members are always "on the same page" when asked about aspects of the task or how it is being carried out.
Shared Mental Models - Moderate	Team members are sometimes "on the same page" when asked about aspects of the task or how it is being carried out, but sometimes their perspectives differ.
Shared Mental Models - Low	Team members are never "on the same page" when asked about aspects of the task or how it is being carried out.
Cohesion – High	The team provides a safe, comfortable environment to openly share ideas.
Cohesion - Moderate	Team members feel safe sharing ideas most of the time, but are sometimes hesitant to share some ideas.
Cohesion - Low	The team does not feel like a safe environment to share ideas.

## **2.2 Method: Content Validity Study**

### *2.2.1 Participants*

Fifty-three Georgia Tech undergraduate respondents participated in the content validity study for course credit. Participants were recruited through the Georgia Tech SONA experiment management system.

### *2.2.2 Procedure*

I derived 15 descriptions of each of the social factors of interest (i.e., team cohesion, team coordination, and team shared mental models) from construct definitions used in the team research literature. These 45 descriptions varied in the strength of the respective construct that was being tested. Respondents were given definitions of team cohesion, team coordination, and team shared mental models (which appeared at the top of the page throughout the study) which they referenced as they read each of the 45 descriptions of the teams. For each description, respondents first indicated the degree to which the description represented each of the three social factors (i.e., team cohesion, team coordination, and shared mental models) by making a selection on three 7-point Likert-type scales ranging from “The Description Does Not At All Represent [social factor]” to “The Description Definitely Represents [social factor].” For every description in which participants provided an answer other than “The Description Does Not At All Represent [social factor],” participants were given a follow up question that asked them about the degree to which the team displayed that particular social factor. For example, if respondents rated a description as anything other than “The Description Does Not At All Represent Team Cohesion,” they received a follow up question that read “How cohesive is this team?,” and selected their answer from the following choices: “Not at all cohesive,” “Somewhat cohesive,” or “Very cohesive.” Similarly, if participants rated a description as anything other than “The Description Does Not At All Represent Team Shared Mental Models,” they received a follow up question that read “How similar are the team members’ mental models?,” and selected their answer from the following choices: “Not at all similar,” “Somewhat similar,” or “Very similar.” Finally, if participants rated a description as anything other than “The Description Does Not At All

Represent Team Coordination,” they received a follow up question that read “How well does the team coordinate?,” and selected their answer from the following choices: “Not at all well,” “Somewhat well,” or “Very well.” The goals of this content validity study were to obtain descriptions for each social factor that (1) reliably captured that particular factor (i.e., criterion relevance), (2) did not capture the other two factors (i.e., no significant criterion contamination), and (3) provided distinguishable low, medium, and high levels for each factor.

## **2.3 Analysis and Results: Content Validity Study**

### *2.3.1 Goal 1: Criterion Relevance*

To analyze the first goal of the content validity study (i.e., criterion relevance), I conducted a repeated measures ANOVA for each of the three social factors, which revealed a significant difference between participant ratings for each of the three factors [ $F(2,24) = 54.928, p < 0.01$ ]. In other words, respondent ratings of team descriptions within each of the social factor categories of interest were significantly different from one another. An analysis of the descriptive statistics revealed three description sets (i.e., a set of high, medium, and low instantiations for each of the social factors) that were scored higher than the other descriptions in their respective category (see Table 1 for these three sets of descriptions).

### *2.3.2 Goal 2: Lack of Criterion Contamination*

It was important not only to identify descriptions that participants rated as highly representative of the intended construct (e.g., team cohesion), *but also* descriptions that

participants did not rate as representative of the other two constructs (e.g., team coordination and team shared mental models). To accomplish this second goal, participants completed three rating scales (one for each of the three team constructs) for each description they were given. For example, for a team description that was intended to describe a team's cohesion, participants provided a rating of that team's cohesion (i.e., the "true" rating), a rating of that team's coordination (i.e., a "false" rating), and a rating of that team's shared mental models (i.e., a "false" rating). If participants rated this description high on the cohesion scale, low on the coordination scale, and low on the shared mental models scale, this description was said to have low criterion contamination. I conducted a repeated measures ANOVA [ $F(2, 24) = 54.93, p < .001$ ] followed by post-hoc Tukey HSD tests for all pairings of the team construct set ratings: Team Coordination and Team Shared Mental Models ( $p < .001$ ), Team Shared Mental Models and Cohesion ( $p < .001$ ), and Team Cohesion and Team Coordination ( $p < 0.05$ ). Further post-hoc paired comparisons analysis yielded a number of descriptions for each social factor within these sets that were significantly distinguishable from the other two social factors ( $p < .001$ ). Although all of the identified descriptions passed the criterion contamination test by reaching statistical significance, the policy capturing approach required that only one set of descriptions (e.g., high, moderate, and low version of cohesion) be used for each factor of interest. Therefore, to select one description set for each social factor, I calculated the difference between the lower confidence interval of a particular team factor rating and the upper confidence interval of each of the other two constructs, and selected the description that maximized the difference between these ratings. In this way, I determined sets of descriptions for each social factor that were

rated significantly different from the other two constructs, and maximized the distance between the rating of that construct of interest and the other two constructs (i.e., minimized the possibility of criterion contamination).

### *2.3.3 Goal 3: Distinguishable Levels of Criterion*

To analyze the third goal of the content validity study (i.e., determine distinguishable levels of each construct), I identified the sets of team descriptions for which participants were able to distinguish between the levels of the factors (i.e., high, moderate, and low) to the greatest extent. A repeated measures ANOVA did not reveal a significant difference between any of the team factor sets [ $F(4, 52) = .663, p=.619$ ]. These results indicated that the sets of team factors did not significantly differ in terms of their ability to distinguish between different levels of the team factors, but it did not necessarily indicate that all of them were effective at doing so. In other words, the analysis simply revealed that none was better than the rest, not that they were all effective (they could have all been equally ineffective). To ensure that the sets of team descriptions were all, in fact, effective at distinguishing between the different levels of the team factors, I calculated the percentage of respondents who “accurately” ranked the description as low, moderate, or high for the follow-up question in the survey (e.g., “How cohesive is this team”). For all team descriptions, at least half of all respondents accurately identified each of the three levels of each team characteristic description, indicating that individuals were able to reliably distinguish between each of the levels for all team characteristics. Based on these analyses, any of the team characteristics descriptions tested would have been valid and reliable descriptions to be used in the policy capturing study. However, the policy capturing approach required that only one set

of descriptions (e.g., high, moderate, and low version of cohesion) be used for each factor of interest, so I selected team descriptions in which the greatest percentage of participants “correctly” identified all levels of the team factor. See Table 2 for the percentage of respondents who correctly identified the level of each team characteristic selected for the policy capturing study.

**Table 2 – Percentage of respondents who correctly identified the intended level of the indicated team factor**

<u>Percentage of Respondents</u>	<u>Team Description</u>
94.3%	Team member actions are tightly synchronized with the other members of their team. [Coordination – High]
83.0%	Team member actions are sometimes synchronized and sometimes out of sync with the other members of their team. [Coordination – Moderate]
81.1%	Team member actions are rarely synchronized with the other members of their team. [Coordination – Low]
90.1%	Team members are always "on the same page" when asked about aspects of the task or how it is being carried out. [Shared Mental Models – High]
73.6%	Team members are sometimes "on the same page" when asked about aspects of the task or how it is being carried out, but sometimes their perspectives differ. [Shared Mental Models – Moderate]
66.0%	Team members are never "on the same page" when asked about aspects of the task or how it is being carried out. [Shared Mental Models – Low]
88.7%	The team provides a safe, comfortable environment to openly share ideas. [Cohesion – High]
75.5%	Team members feel safe sharing ideas most of the time, but are sometimes hesitant to share some ideas. [Cohesion – Moderate]
75.5%	The team does not feel like a safe environment to share ideas. [Cohesion – Low]

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*Note.* Results of the third goal of the content validity study (i.e., distinguishing between the levels of the team characteristics). Percentages of respondents who correctly identified the level of the team description are indicated in the left column, and the associated team descriptions are indicated in the right column.



## **2.4 Method: Policy Capturing Study**

### *2.4.1 Participants*

The policy capturing technique allows researchers to achieve a power level equivalent to traditional versions of a repeated measures test, but with fewer participants. This is because, in the policy capturing method, respondents make a series of judgments based on a number of conditions as opposed to a few observations based on a few conditions. This is referred to as a subjects-by-condition design ( $S \times C$  designs; Cohen & Cohen, 1983), which yields more reliable data and smaller standard errors than if respondents provided only a few observations (Cooksey, 1996; Howell, 1992). However, there is no clear direction on conducting a power analysis on a policy capturing method, other than carrying out the analysis as if it were a repeated-measures design, and using this as a conservative estimate of required sample size (Cohen, 1988). Therefore, I conducted a power analysis using an estimated effect size of Cohen's  $f = 0.3$ , statistical power of 0.95,  $\alpha = .05$  which yielded a sample size of thirty-three participants. For this study, 100 participants completed the study, which was well above the conservative estimate of an appropriate sample size for a repeated measures design.

The literature does not indicate an appropriate effect size for judgments of how attractive a team is to work with. Therefore, this medium effect size was chosen because small differences in the level of attractiveness of a particular team may not be informative in terms of practical applications of how individuals distribute their time across teams in a work session. On the other hand, setting the effect size too large may lead to a failure to capture any meaningful difference between team attractiveness judgments that underlie an individuals' team task management decisions.

Participants were recruited through a Qualtrics panel. A number of screening elements were built into the survey to help ensure that all participants who completed the survey were (1) representative of the population of interest, and (2) were diligently answering survey questions. Participants were professional workers who were currently employed, worked forty or more hours per week, were knowledge workers, passed three “attention filters” that were built into the survey to ensure that all participants were paying attention to survey questions (e.g., *“This is an attention filter. Please select “Strongly Disagree” for this statement.”*), and did not select the following answer choice when asked *“How would you describe your job?”*: *“All of my work is independent; I am capable of doing all, or nearly all, of my work without relying on others.”* Participants also had to select the correct answer regarding the definition of a team, after a definition was provided to them to read. This question served not only as an additional attention filter, but ensured that participants understood what constitutes a team before they were allowed to answer the team task management questions.

In addition to screening criteria that ensured that our sample represented the population of interest, I also collected demographic information on all participants. The ethnicity with which participants identified was represented as follows: White = 73%, Black or African American = 14%, Asian = 7%, Other = 4%, American Indian = 1%, Native Hawaiian or Pacific Islander = 1%. Gender was represented as follows: Male = 50%, Female = 50%, Other = 0%. The level of fluency in English was represented as follows: Fluent = 95%, Conversational = 4%, Basic = 1%, None = 0%.

## **2.5 Procedure**

### *2.5.1 Phase 1: Judgment Policies*

The first step in policy capturing is to develop multiple “scenarios” that provide participants with information that they will use to make judgments about a particular situation. In this study, I selected social factors of interest that individuals use when deciding whether or not to work with a team and specified various levels of these social factors (e.g., team cohesion could be low, medium, or high). The team descriptions that were selected to construct these “scenarios” (see Table 1) were those in which at least 66.0% ( $M = 80.9\%$ ) of respondents correctly identified the team factor (e.g., cohesion) as well as the level of the team factor (e.g., high cohesion, moderate cohesion, or low cohesion) that was represented by the statement (see previous section for a detailed description of the content validity analyses). First, I constructed team vignettes that included every combination of the strength of each team factor. For example, one vignette described a team that was low in cohesion, high in coordination, and moderate in shared mental models while another vignette described a team that was high in cohesion, low in coordination, and moderate in shared mental models. In this way, I constructed 27 vignettes to represent every combination of the each level of the three team characteristics. Every participant read each of these 27 vignettes, and the order in which the vignettes were presented was randomly assigned to each participant.

After reading each team vignette, participants provided their subjective judgment on how attractive that team was to work with by making a selection on a 9-point Likert-type scale ranging from “This team is not at all attractive” to “This team is very attractive.” Because I systematically varied the strength of each of the three team factors across all 27 scenarios, and participants provided judgments on the team’s attractiveness for each of these 27 scenarios, I was able to derive a regression model for each

participant to identify how they weighted each of the three team characteristics when making their judgments. Each participant's regression model indicated whether or not a team characteristic was a significant predictor of their judgment (i.e., significance testing for the three standard regression coefficients associated with the three team characteristics) as well as the relative importance of the team factor to that judgment (i.e., the magnitudes of the standard beta regression coefficients). For example, some individuals seemed to base their ratings of team attractiveness on how cohesive that team was, and would rate a highly cohesive team as very attractive to work with regardless of the team's coordination or how much they seemed to be "on the same page." These individuals placed much higher importance on team cohesion than either team coordination or team shared mental models, which was reflected in relatively high regression coefficients for the cohesion variable in their regression models.

Although capturing participants' judgment policies in this way provided the relative importance of each of the team characteristics for each participant, it did not necessarily provide a direct indication of the choices participants would make when deciding between multiple teams. This is because the underlying decision processes that give rise to an individual's choices may be influenced by factors outside of an individual's judgment policies (e.g., Glöckner, 2009). I investigated these choice scenarios in Phase 2 of Study 1.

### *2.5.2 Phase 2: Team Choice Scenarios*

In the second phase of Study 1, I constructed a number of scenarios in which participants had to decide to either remain on a current team or switch to an alternative team. Within the scenarios, I referred to the team with whom the participant was

currently working as the “current team,” and the team whose goals the participant was considering switching to work on as the “alternative team.” Participants read each scenario and indicated how likely they would be to remain on the current team or switch to the alternative team. Participants provided their answers on a 9-point Likert-type scale ranging from “Would definitely continue working with the Current Team” to “Would definitely switch to work with the Alternative Team.” Again, the strength of each team characteristic varied across the scenarios.

The team choice scenarios that I constructed for this section were a subset of all possible combinations of team characteristics. It was necessary to select a subset of scenarios because presenting the full set of every combination of the three team characteristics across all three levels of these characteristics for both the current and the alternative team resulted in 729 possible combinations. Therefore, to mitigate possible fatigue effects from making decisions for hundreds of scenarios, a subset of 36 scenarios was selected. This number was chosen for two reasons. First, when combined with the 27 scenarios from the previous section, the number of scenarios fell within the recommended range of 10-15 scenarios per decision factor (i.e., 60-90 scenarios; Cohen & Cohen, 1984).

Second, I selected scenarios that allowed me to differentiate between different ways that participants might have combined team factors to arrive at their decisions. For instance, one way that individuals may implicitly use the three team factors is to base their decision completely on the one factor that they consider the most important (i.e., “take-the-best” heuristic; Gigerenzer, 2008). For example, if team cohesiveness were the most important factor for an individual, he or she would choose the team that was the

most cohesive, regardless of how coordinated the team was or how much they seemed to be “on the same page.” Another way that individuals may implicitly use the three team factors is to weight the team factors based on their relative importance, sum up the weighted values for each team, and then select the team that with the highest score (i.e., “weighted additive” compensatory approach; Bröder & Newell, 2008). For example, if team cohesion was the most important factor for an individual, followed by team coordination and team shared mental models, he or she would consider all three factors, but would give the most weight to the value of team cohesion, less weight to team coordination, and the least amount of weight to team shared mental models. In this way, individuals using these two different decision strategies would make the same choice if team cohesion were high for at least one team, but would differ if cohesion were low for both teams and the other two factors varied. The 36 scenarios that I constructed for this study allowed me to differentiate between three take-the-best heuristic strategies (i.e., take-the-best cohesion, take-the-best coordination, and take-the-best shared mental models) from weighted additive compensatory approaches by systematically varying the team factors in ways that allowed me to distinguish one strategy from all others. This approach helped to ensure that any possible dependencies that may have existed between team factors due to a participant’s use of a particular decision strategy did not prevent me from identifying the most important team factors across all participants. Every participant provided team choice answers for these same 36 scenarios, and the order in which each scenario was presented was randomly assigned to each participant.

### *2.5.3 Predicting Team Choices*

From the regression models that I generated in phase 1 (i.e., their judgment policies), I was able to generate predictions about which team each participant would choose for each scenario in phase 2. Specifically, for each participant, I generated attractiveness values for each of the two teams based on the participant's regression model derived in phase 1, compared the predicted judgment values for each of the two teams, and converted those values to a binary choice of “remain on current team” or “switch to alternative team” depending on which team had the higher predicted attractiveness value. Next, I tested those predictions against the actual participants' decisions provided in the choice scenarios. In other words, I tested the predictive validity of the participants' policies (captured in phase 1) for predicting their actual choices in phase 2.

## **2.6 Experimental Design**

The study design was a within-subjects crossed design, with social factors as the independent variables (team cohesion; team coordination; shared mental models). The dependent variable in phase 1 was team attractiveness judgments, and the goal of this phase was to identify individuals' decision policies that underlie their judgments about what makes a team attractive to work with. The dependent variable in phase 2 was team task switching decisions (likelihood of remaining on the current task), and the goal of this phase was to capture actual team task switching choices (in a scripted scenario), and compare these choices to the choices that would be predicted given their decision policies captured in phase 1.

## **2.7 Analysis**

The policy capturing approach quantifies the implied social rules (i.e., team factors) that individuals use when making judgments about teams, ultimately leading to team task switching decisions. In this dissertation, the policy capturing technique was divided into two phases: (1) analysis of participants' judgments about which teams would be attractive to work with based on selected team factors, and (2) validation of team judgments by comparing predictions of team task switching decisions based on participant policies captured in phase 1 to actual team task switching decisions made in phase 2.

#### *2.7.1 Phase 1: Judgment Policies*

To identify the social factors that underlie participants' judgments about teams, as well as the relative weights of these factors, I conducted a multiple regression analyses for each participant. Specifically, the ratings of how attractive a team would be to work with served as the dependent variable, and the social factors embedded in the scenarios that led to these decisions served as the independent variables. I regressed the participants' judgments on the social factors, which provided an indication of which factors significantly influenced their judgments of whether or not they would like to work with the team, along with the direction of the observed relationship. Team factors found to significantly influence participant judgment ratings in the hypothesized direction were identified for each participant. Next, following the policy capturing technique used by Webster and Trevino (1995), for each team factor, I summed the number of participants for whom the factor was significant. This technique allowed me to compare the relative importance of each team factor across all participants. Specifically, I identified the team



factor that significantly predicted participant judgments of teams for the greatest number of participants, and so on.

### *2.7.2 Phase 2: Predicting Team Task Management Choices*

To determine if the participant policies captured in Phase 1 could predict their choices in a team task management situation, I compared predictions from each participant's multiple regression models collected in Phase 1 to their actual choices made in Phase 2. The outcome of the analysis in Phase 1 was a multiple regression model for each participant that provided values for the relative importance of each team factor to their judgment (of how attractive a team was to work with) in the form of standardized beta weights. Using these beta weight values, I calculated the probability that a participant would remain on the current team or switch to the alternative team based on predictions of how they would judge the attractiveness of both the Current team and the Alternative team. To this end, I obtained a "predicted attractiveness value" for each of the two teams, and compared those values to determine which team they might choose to work with.

Specifically, for each of the two teams [i.e., Current Team (CT) and Alternative Team (AT)], I calculated the predicted judgments of the teams' attractiveness by: (1) converting the low, moderate, and high levels of each of the three team factors described in the scenarios into ordered numerical values, (2) multiplying those values by the participant's beta weights associated with each factor (from the participant's regression model obtained in Phase 1 analysis), and (3) obtaining a "predicted attractiveness value" for the team by summing the values obtained in step 2. I used these two predicted team

attractiveness values to calculate the “predicted probability of staying” on the CT for each participant using formula 1:

$$\begin{aligned} & \text{Predicted probability of staying on CT} \\ = & \frac{\text{CT predicted attractiveness}}{\text{CT predicted attractiveness} + \text{AT predicted attractiveness}} \end{aligned} \quad (1)$$

Next, I obtained an “actual probability of staying” score from participants’ actual choices made in Phase 2. Specifically, I converted participant choices on the Likert-type scale indicating how likely they would be to remain on the CT (ranging from 1 = “Would definitely continue working with the Current Team” to 9 = “Would definitely switch to work with the Alternative Team”) using formula 2:

$$\begin{aligned} & \text{Actual probability of staying on CT} \\ = & \frac{(\text{Participant's selection on 1 – 9 Likert – type scale}) - 1}{8} \end{aligned} \quad (2)$$

Finally, to test the relationship between the predicted and actual probabilities, I conducted a Pearson Correlation for each participant’s pair of “predicted probability of staying on CT” and “actual probability of staying on CT.” The Pearson correlation provided a significance test for the relationship between the change in a participant’s predictions and their actual choices as the values for the team factors changed across all team task management scenarios. Assuming that the identified relationship was positive (e.g., the predicted probability of remaining on the CT increased as the participant’s actual probability of remaining on the CT increased), a significant correlation indicated

that a participant's judgment policy (i.e., the relative importance of team factors to that individual's judgments of team attractiveness) reliably predicted their choices in a team task management scenario (i.e., Phase 2). Furthermore, I tested the predictive value of participants' policies against an individual choosing teams at random to obtain a significance value for the predictive validity of using this method.

## 2.8 Results

### 2.8.1 Phase 1: Judgment Policies

Ordering the factors from the greatest number of participants for which the team factor was significant to the least number of participants for whom the team factor was significant provided a ranking of the most influential team factors in judgments of team attractiveness. As shown in Table 3, team cohesion received the greatest percentage of participants for whom the team factor was a significant predictor of team attractiveness.

**Table 3 – Percentage of standardized beta weights associated with each team factor that were significant in the team attractiveness scenario ( $N = 100$ )**

	Team Factors		
	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>
<u>Team Attractiveness</u>	66% ( $n = 66$ )	54% ( $n = 54$ )	33% ( $n = 33$ )

*Note.* Results of Phase 1 of the Policy Capturing study indicating the importance of each team factor in team attractiveness judgments. Columns indicate the team factors that influence team judgments about how attractive the team is to work with and the cells indicate the percentage of participants (along with the associated number of participants) for whom the beta weights for the team characteristics were significant (i.e., the team characteristic explained a significant amount of variance in judgments for how attractive the team was to work with). SMM = Shared Mental Models

A chi-square test revealed that a difference did exist across all three team factors [ $\chi^2 (2, N = 100) = 10.94, p < .01$ ], and post-hoc paired-comparisons revealed that the significant differences existed between Cohesion and Coordination ( $p < .001$ ) and between Shared Mental Models (SMM) and Coordination ( $p < 0.01$ ), but no significant differences existed between Cohesion and SMM. In other words, both Cohesion and SMM predicted team attractiveness judgments for a significantly greater percentage of participants than did Coordination, but the percentage of participants for whom Cohesion and SMM significantly predicted team attractiveness judgments was statistically equivalent. However, an examination of the raw percentages shows that Cohesion significantly predicted team judgments for 12% more participants than did team SMM.

### 2.8.2 Phase 2: Predicting Team Task Management Choices

I conducted a Pearson's correlation on each participants' predicted values (based on their policies obtained in Phase 1) and actual values (derived from their actual team task switching choices in Phase 2), and obtained significance values for each correlation. For 46.0% of all participants, the predicted team choices were significantly correlated (at  $p < 0.05$ ) with their actual choices made in Phase 2 of the study (average Pearson correlation coefficient;  $r = 0.26$ ). To compare these results to participants who would have chosen teams at random, I generated random predicted value scores for 100 "simulated" participants and carried out the same analyses. For these randomly-generated team choice predictions, 8% were significantly correlated (at  $p < 0.05$ ) with actual choices made by participants (average Pearson correlation coefficient;  $r = -0.01$ ). A chi-square test showed that these percentages were significantly different [ $\chi^2 (1, N = 54) = 26.74, p < .001$ ], confirming that the predictive values generated using participants'

policies from Phase 1 were significantly more predictive of team task management choices than choosing teams at random. These results suggest that respondents' policies were indeed predictive of their choices in a separate team task switching scripted scenario.

### 2.8.3 *Investigating Team Characteristics' Attractiveness Versus Stickiness*

Not only did Phase 2 of the policy capturing study allow me to verify the predictive validity of participant team task management policies that were captured in Section1, it also provided a way to compare the relative importance of *both* the current team's characteristics and the alternative team's characteristics. This is because participants made choices based on *both* the characteristics of a team on which they were "currently" working and the characteristics of an "alternative" team that was available to work with should they choose to do so. In other words, their team task management decisions were now regressed on the Cohesion, SMMs, and Coordination factors of both the current team and the alternative team. As reported in the previous analyses on Phase 1 of the Policy Capturing study, Table 4 includes the percentage of participants for whom each team factor, on both the "Current Team" (CT) and the "Alternative Team" (AT), was a significant predictor of team attractiveness.

**Table 4 – Percentage of standardized beta weights associated with each team factor that were significant in the team task switching scenario (N = 100)**

	Current Team (CT) Factors			Alternative Team (AT) Factors		
	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>
<u>Team</u> <u>Choice</u>	37% (n = 37)	24% (n = 24)	13% (n = 13)	30% (n = 30)	21% (n = 21)	19% (n = 19)

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*Note.* Results of Phase 2 of the Policy Capturing study indicating the importance of each team factor in team task switching choices. Columns indicate the team factors that influence team judgments about how attractive the team is to work with and the cells indicate the percentage of participants (along with the associated number of participants) for whom the beta weights for the team characteristics were significant (i.e., the team characteristic explained a significant amount of variance in choosing which team to work with). SMM = Shared Mental Models

One thing to note here is that the percentages of significant beta weights are lower, in general, than those found in Phase 1. One possible explanation for this is that there are now twice as many factors to consider when making judgments about teams, which can be difficult to process for a decision maker. Said differently, there are now twice as many factors pushing and pulling respondents towards and away from the two teams. However, despite the relatively high number of factors to be processed, differences were still found in the level of influence of team factors on team task switching decisions. Specifically, a chi-square test revealed that a difference did exist across all six team factors [ $\chi^2$  (5,  $N = 145$ ) = 14.52,  $p < .05$ ], and post-hoc paired-comparisons revealed that the Current Team (CT) Cohesion factor drove most of this difference. Specifically, the influence of CT Cohesion was significantly greater than CT Coordination ( $p < .001$ ), Alternative Team (AT) Coordination ( $p < 0.05$ ) and AT SMM ( $p < 0.05$ ). One other paired significant difference was driven by the fact that CT coordination was relatively low compared AT Cohesion ( $p < 0.05$ ) (and low compared to CT Cohesion, which was previously reported). These results do not provide support for a significant difference between the stickiness and attractiveness of a particular factor, but they do provide additional evidence that cohesion stands out as the most influential factor to team task management decisions.

#### 2.8.4 *Exploratory Analysis: Team Factor “Policy Profiles”*

The goal of Study 1 was to determine the most important team factor to team task management decisions. However, the initial results of Study 1 indicated that Cohesion and SMMs were statistically equivalent predictors of team task management decisions. Specifically, in Phase 1 of Study 1, Cohesion significantly predicted team judgments for 12% more participants than did SMMs, but this difference did not reach statistical significance. Although the descriptive statistics showed that Cohesion might be more influential than SMMs (although not statistically so), I used a cluster analysis technique to further investigate the relationship between team factors and individual participant judgments. This approach added to the summative approach from Phase 1 of Study 1 that provided an indication of which factors were the *most* influential for the *most* participants by uncovering possible underlying differences in how individual participants utilized all three team factors at once to make this determination. I referred to the utilization of the three team factors as a participant’s “policy profile.” The “policy profiles” described how participants weighted each of the team factors when making their judgments (i.e., an idiographic perspective on judgment policies; Stewart, 1988).

#### 2.8.5 *Cluster Analysis of Standardized Beta Weights*

Whereas the preceding analysis showed the direct influence of each of the three team factors on an individual’s judgments of team attractiveness, I also wanted to determine how individuals may use the three factors collectively when making these judgments. To accomplish this, I used a cluster analysis technique. The cluster analysis technique is an exploratory method used to group participants into meaningful sets based

on values provided on one or more constructs of interest (e.g., Kaufman & Rousseeuw, 2009). For my dissertation, the values I used for the cluster analysis were participants' beta weights derived from the multiple regression models calculated in Phase 1 of Study 1. These beta weights served as an indication of the relative importance of each of the three team factors to each participant's judgments of team attractiveness. In this way, the cluster analysis technique served as a method to systematically group participants into categories based on how influential the three team factors were to their judgments of team attractiveness. Said differently, the three team factors served as the three dimensions along which participants were categorized.

I used a mixture model (Hicks, Markon, Patrick, Krueger, & Newman, 2004) cluster analysis technique because categorizing cases on three variables (i.e., categorizing participants based on their three beta weight values) requires using clustering parameters that are appropriate for defining sets in multi-dimensional (and not two-dimensional) space. Mixture models handle this complexity by clustering cases based on their mean vectors (rather than simple means) and the amount of dispersion between members of each potential group. In this study, the mixture model created distinct categories of participants based on the difference in beta weight mean vectors (there were three beta weights associated with the three team values, so vectors described the relationship between these three values) and the amount of variance in beta weight values within each potential group.

#### *2.8.6 Policy Profiles Yielded from Cluster Analysis*

The cluster analysis yielded three groups of individuals that utilized each of the three team factors similarly within each of the groups. For the first group of participants



( $n = 39$ ), Cohesion was found to be a strong predictor, and the other two team factors were moderate or low predictors of team attractiveness. As shown in Table 5, team cohesion received the greatest percentage of participants for whom the team factor was a significant predictor of team attractiveness.

**Table 5 – Percentage of standardized beta weights associated with each team factor that were significant in the “Cohesion Matters Most” group ( $N = 39$ )**

	Group 1: Team Factors		
	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>
<u>Team Attractiveness</u>	100% ( $n = 39$ )	72% ( $n = 28$ )	26% ( $n = 10$ )

*Note.* Team factor importance for group one of the exploratory cluster analysis (i.e., “Cohesion Matters Most” group). Columns indicate the team factors that influenced judgments about how attractive the team was to work with and the cells indicate the percentage of participants (along with the associated number of participants) for whom the beta weights for the team characteristics were significant (i.e., the team characteristic explained a significant amount of variance in judgments for how attractive the team was to work with). SMM = Shared Mental Models

A chi-square test revealed that a difference did exist across all three team factors [ $\chi^2 (2, N = 39) = 16.70, p < .001$ ], and post-hoc paired-comparisons revealed that significant differences existed between Cohesion and Coordination ( $p < .001$ ), Cohesion and Shared Mental Models (SMM) ( $p < 0.05$ ), and between Shared Mental Models (SMM) and Coordination ( $p < 0.01$ ). In other words, for this group, Cohesion was the most influential team characteristic (and significantly so), SMMs was also influential (but significantly less so than Cohesion), and Coordination was significantly less influential than SMMs. I referred to this first group as the “Cohesion Matters Most” group.

For a second group ( $n = 15$ ), all three team factors (i.e., Cohesion, SMMs, and Coordination) were strong predictors of team attractiveness. As shown in Table 6, all

three team factors were significant predictors of team attractiveness judgments for 100% of participants.

**Table 6 – Percentage of standardized beta weights associated with each team factor that were significant in the “Everything Matters” group ( $N = 15$ )**

Group 2: Team Factors			
	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>
<u>Team Attractiveness</u>	100% ( $n = 15$ )	100% ( $n = 15$ )	100% ( $n = 15$ )

*Note.* Team factor importance for group two of the exploratory cluster analysis (i.e., “Everything Matters” group). Columns indicate the team factors that influenced judgments about how attractive the team was to work with and the cells indicate the percentage of participants (along with the associated number of participants) for whom the beta weights for the team characteristics were significant (i.e., the team characteristic explained a significant amount of variance in judgments for how attractive the team was to work with). SMM = Shared Mental Models

A chi-square test revealed that no differences existed across the three team factors for this second group. In other words, for this group, all three team characteristics were equally as influential in team task management decisions. I referred to this second group as the “Everything Matters” group. In *both* of these first two groups, Cohesion was very influential. However, SMMs were only moderately influential in the “Cohesion matters most” group, but were very influential in the “Everything Matters” group. This difference in the strength of the SMM factor across the two groups provided a possible explanation for why the overall Cohesion and SMM beta weights differed in the initial analysis, but did not reach statistical significance.

In the third group ( $n = 46$ ), the influence of all three team factors on team attractiveness judgments were low, and, therefore, did not help differentiate between the Cohesion and SMM team factors. As shown in Table 7, no single factor was a large

significant predictor of team attractiveness judgments for a large percentage of participants.

**Table 7 – Percentage of standardized beta weights associated with each team factor that were significant in the “Nothing Stand Out” group ( $N = 46$ )**

Group 3: Team Factors			
	<u>Cohesion</u>	<u>SMM</u>	<u>Coordination</u>
<u>Team Attractiveness</u>	26% ( $n = 12$ )	24% ( $n = 11$ )	17% ( $n = 8$ )

*Note.* Team factor importance for group three of the exploratory cluster analysis (i.e., “Nothing Stands Out” group). Columns indicate the team factors that influenced judgments about how attractive the team was to work with and the cells indicate the percentage of participants (along with the associated number of participants) for whom the beta weights for the team characteristics were significant (i.e., the team characteristic explained a significant amount of variance in judgments for how attractive the team was to work with). SMM = Shared Mental Models

A chi-square test showed no significant differences across the three team factors for this third group. In other words, for this group, all three team characteristics were equally as influential in team task management decisions and the team factor influence were relatively low compared to the other groups. I referred to this third group the “Nothing Stands Out” group, because, although team factors were influential for roughly 1/5 to 1/4 of participants, no factor stood out as clearly guiding their decisions. Additionally, for this relatively large group (46 out of 100 participants), there seems to be a lot of unexplained influence on team task management behavior other than the three team factors investigated in this study, which is discussed further in the discussion section.

### 2.8.7 Exploratory Analysis: Modeling Individual Team Task Management Strategies

In addition to understanding how team factors may differentially influence team task management decisions, I wanted to understand how the team was viewed as a whole across all three team factors. I used two techniques to gain this more veridical representation of how teams may be viewed in the real world, where cohesion, shared mental models, and cohesion are present to some degree on every team. First, the previously described cluster analysis technique provided groups of individuals that utilized similar “policy profiles” when making judgments of whether or not a single team would be attractive to work with. Within these groups, significant beta weights were summed across participants to provide a rough estimation of the importance of each team factor within those groups. Although this provided high-level trends for relative importance of team factors across participant groups, it also led to the loss of individual-level information, such as strategies that underlie decisions. To gain these individual-level insights, I utilized a cognitive modeling approach to uncover decision strategies that describe how multiple team factors may influence individuals when the factors are considered collectively during a team task switching scenario (i.e., Part 2).

One strategy that some individuals use when making decisions is the “Equal Weight” strategy (EW; e.g., Shah & Oppenheimer, 2008) in which all decision factors have the same influence on the decision maker, and only the strength of the factors determines their decisions. In terms of team task management, individuals utilizing an EW strategy would not be influenced by one team factor (i.e., Cohesion, SMM, Coordination) more than any others. They would be equally as sensitive to all three factors, and their decisions of how attractive a team would be to work with would be based on increasing or decreasing levels of any of the team factors. For example, these

individuals would view a team that was High in Cohesion, Low in Shared Mental Models, and Low in Coordination the same as a team that was Low in Cohesion, High in Shared Mental Models, and Low in Coordination (or high in Coordination and low in the other two factors).

A second strategy that some individuals may utilize in a team task management situation is a “Take-The-Best” strategy (TTB; e.g., Gigerenzer & Goldstein, 1996). As opposed to the EW strategy, in take-the-best, the team factors do matter relative to one another. Specifically, one of the team factors influences their decisions more than the other two. For example, an individual utilizing a TTB Cohesion strategy would be influenced far more by Cohesion than the other two factors. Said differently, when working on multiple teams, they would look solely at the teams’ levels of cohesion when deciding how to allocate their time. In this way, individuals can take a “shortcut” approach (i.e., heuristic; Czerlinski, Gigerenzer, & Goldstein, 1999) to managing their time across teams by basing their decisions solely on a single factor that has “worked well” for them in the past. In this study, this family of strategies comprises three strategies: (1) TTB Cohesion, (2) TTB Shared Mental Model, and (3) TTB Coordination.

#### *2.8.8 Bayesian Model Comparison*

In order to identify individuals who were using any of these four strategies when choosing between teams in Part 2 of the Policy Capturing study, I utilized a Bayesian Model Comparison approach known as the Bayesian Information Criterion (BIC; e.g., Bussemeyer & Diederich, 2010). The BIC is typically used to compare competing cognitive models (mathematical representations of cognitive decision making processes) to see which of two models best explains a set of observed data, based on the predictions

each would make for that set of data. In the case of team task switching strategies, I used the BIC approach to compare the model of each participants' "policy" captured in part 1 to models that represent the four decisions strategies: (1) EW, (2) TTB Cohesion, (3) TTB Shared Mental Model, and (4) Take-The-Best Coordination. In this way, if an individual's policy model's predictions were found to be similar to those of one of the strategy models, then it would be as if they were using that strategy when making team task switching decisions. However, to use the BIC in this way, I had to modify the interpretation of the outcome values from the BIC analysis.

#### *2.8.9 Modifying Bayes Factor Cut-Offs to Identify Team Task Switching Strategies*

Because the typical application of the BIC approach is to identify the model that has the best fit for a given data set (and not to identify models that make similar predictions, as is the case in the current study), the outcome of the BIC analysis is similar to an odds ratio – one model is described in terms of number of times it is more likely to produce the observed data than a second model. The odds for favoring one model over the other are described in terms of a Bayes Factor (BF), which is the outcome of BIC analysis. For example, a BF of 15 would mean that the odds are fifteen times greater for Model A to produce the observed data than for Model B to produce the same data. Because this is a Bayesian approach, there are no null-hypotheses statistics tests associated with the results. However, there are standard Bayes factor cutoff values (i.e., Jeffrey Rating Scale; Wasserman, 2000) that provide the degree to which one model is a better fit for the data. For the purposes of the current study, I modified the rating scale for the BF cutoff values to the following: 0.1-10 ("The Policy Model and the specified Strategy Model fit the data *Equally as well*"), 10-150 (or 0.007-0.1) ["The Policy Model

fit the data *Somewhat better* than the specified Strategy Model (or the specified Strategy Model fit the data *Somewhat better* than the Policy Model”)], and  $>150$  (or  $<0.007$ ) [“The Policy Model fit the data *Much better* than the specified Strategy Model (or the specified Strategy Model fit the data *Much better* than the Policy Model”)]. For example, if an individual’s policy model captured in Study 1 was compared to a Take-The-Best Cohesion strategy model and received a Bayes Factor of 1.5, the policy model would only be one and a half times as likely to produce the observed results, which would fall with the values labeled “The Policy Model and the specified Strategy Model fit the data *Equally as well.*” This would mean that it was as if the participant was using a TTB Cohesion strategy, and was very likely only influenced by the level of Cohesion on the two teams (and not their Shared Mental Model or Coordination) when choosing between them.

#### *2.8.10 Policy Profiles and Strategy models*

In Part 1 of this study, I identified policy profiles for each participant comprising the standardized beta weights from their respective multiple regression model. These beta weights provided values for the relative importance of each team factor (Cohesion, Shared Mental Models, and Cohesion) on their judgment of teams that would be attractive to work with. In the current Bayesian Model Comparison analysis, these weights provided a “policy model” that was used to predict judgments in the team task switching scenarios (see the previous section for the equation used to make judgment predictions based on beta weight values). In the current comparative modeling analyses, these predictions served as likelihoods of choosing one team versus another that can be compared to the likelihoods provided by the four additional strategy models.

To construct strategy models that represent the four strategies of interest, I assigned parameters to each model that characterized the importance that would be placed on each team factor under that given strategy. First, in the EW strategy, the parameters associated with Team Cohesion, Team Shared Mental Models, and Team Coordination were all assigned a value of 0.33 (i.e., each factor was weighted equally in terms of importance). Second, in the TTB Cohesion strategy model, the parameters were assigned as follows: Cohesion = 1, Shared Mental Model = 0, and Coordination = 0. In other words, the only factor that mattered in this strategy was Cohesion, and the other two team factors were cancelled out in the model. I used this same logic for the two remaining TTB strategies (i.e., Shared Mental Model and Coordination). Third, in the TTB Shared Mental Model strategy model, the parameters were assigned as follows: Cohesion = 0, Shared Mental Model = 1, and Coordination = 0. Fourth, in the TTB Coordination strategy model, the parameters were assigned as follows: Cohesion = 0, Shared Mental Model = 0, and Coordination = 1. These parameters were used to model the likelihood that individuals using these strategies would choose to remain on the Current Team or switch to the Alternative Team in each of the 36 scenarios in Part 2 of the Policy Capturing study. This was accomplished using the same method described in Part 2 to obtain a “predicted attractiveness value” for both the Current Team and Alternative team, and then calculating a likelihood of remaining on the Current Team based on those values. I then took the Pearson Correlation of these values with the actual ratings that participants provided in Part 2 on each Team Task Switching scenario. Squaring these correlations provided the coefficient of determination ( $r^2$ ) used to calculate fit metrics for each strategy model relative to the policy model. Formulas 3



and 4 below provide the two fit statistics used to compare the policy model to each strategy model, where N=number of trials (i.e., 36):

$$\Delta BIC = BIC_B - BIC_A = N \ln [ (1 - r^2_B) / (1 - r^2_A) ] \quad (3)$$

$$BF_{AB} = e^{\Delta BIC} \quad (4)$$

Because each Strategy Model was compared to the participant policy models derived from Part 1 of the Policy Capturing study, a low BF (i.e., from 0.1-10) for a strategy model comparison would indicate that the participant made choices as if they were using that particular strategy. Table 8 provides the percentage of participants that fell into each of the three categories that related the fit of their Policy Models to the fit of the Strategy Models.

**Table 8 - Percentage of participants whose decision policy models fit the data equally as well as the indicated strategy models (top row)**

	Strategy Model to Which the Policy Model was Compared			
	Equal Weight	TTB Cohesion	TTB SMM	TTB Coordination
The Policy Model and the specified Strategy Model fit the data <i>Equally as well</i>	52%	61%	48%	49%

The Policy Model fit the data <b><i>Somewhat better</i></b> than the specified Strategy Model (or the specified Strategy Model fit the data <b><i>Somewhat better</i></b> than the Policy Model	13% (7%)	7% (8%)	11% (1%)	11% (2%)
The Policy Model fit the data <b><i>Much better</i></b> than the specified Strategy Model (or the specified Strategy Model fit the data <b><i>Much better</i></b> than the Policy Model	20% (0%)	14% (10%)	35%(5%)	36%(2%)

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*Note.* Model fit criterion was the Bayes Factor (BFs) for participants' policy models and each of the indicated strategy models. The categories selected for indicating a comparison of goodness of fit between models are based on Jeffrey's classification method of BFs. The top category includes BFs within the range of 0.1 to 10, the middle category includes BFs in the ranges of 10-150 or 0.007-0.1, and the bottom category includes BFs >150 or <0.007. The important row to consider for the current study is the top row, which indicates the percentage of participant for whom their policy model fit the data equally as well as a model that was choosing teams based on the indicated strategy.

As shown in Table 8, 61% of all participants' Policy Models fit the data as well as models of the Take-The-Best Cohesion strategy, as compared to 52%, 48%, and 49% for EW, TTB SMM, and TTB Coordination, respectively. These findings indicate that the greatest percentage of participants' Policy Models captured in Study 1 fit the data as well as if Cohesion were weighted more than any other team factor. These findings provide additional support to my previous findings that point to Cohesion as standing out as the most important team factor.

#### *2.8.11 Fit Statistics for All Models*

In addition to comparing the Policy Model captured in Part 1 to each Strategy Model to determine which strategy models fit the data equally as well as the Policy Model, I compared the Policy Model and each of the Strategy Models against a random model. This allowed me to obtain fit statistics for each model, which describe the odds with which each model fit the data over and above a random model. In other words, whereas in the previous BIC analysis, I compared the fit of each Strategy Model to the fit of the Policy Model to see if they made similar predictions on the participants' team task switching choices, this additional approach provided a way to estimate the fit of each model directly to those team task management choices. This provided a more direct comparison of which model best fit the data directly.

Using the likelihoods provided by correlating the model predictions with the actual team task switching choices, I derived the BICs, and BF<sub>s</sub> for participants' Policy Models and each Strategy Model (Table 9). The fit metrics are all relative to random models. Overall, the Policy Model (derived from participants' ratings of team attractiveness in Part 1) was the best fitting model with a BF equal to  $5.04 \times 10^{272}$  in favor of Policy Models over a random model. The next best model was TTB Cohesion with a slightly smaller BF of  $1.95 \times 10^{224}$ . It is important to note here that the similar BF<sub>s</sub> for the Policy Model and the TTB Cohesion model was to be expected, given the close comparison between Policy Models and Cohesion in the previous BIC analysis. The EW model came in third with a considerably smaller BF of  $1.08 \times 10^{44}$ , TTB SMM came in fourth with a BF of  $2.04 \times 10^{37}$ , and TTB Coordination came in last with a BF of only  $1.28 \times 10^1$ . Moreover, Policy Model was 150 times more likely to be a fit for the data over and above a random model for 38 participants, which was higher than any other

model. TTB Cohesion was a clear second at 30 participants (see Table 10). These results added to the comparisons made between the Policy Model and Strategy Models by demonstrating the goodness of fit for each of the models to the team task switching data, with the Policy Model and TTB Cohesion standing out above the rest.

**Table 9 - Classification of Team Task Switching choice data from Part 2 of the Policy Capturing study.**

	Fit Statistics	
	Delta BIC	BF
Policy ( <i>from Part 1</i> )	627.92	$5.04 \times 10^{272}$
TTB Cohesion	516.45	$1.95 \times 10^{224}$
EW	101.39	$1.08 \times 10^{44}$
TTB SMM	85.91	$2.04 \times 10^{37}$
TTB Coordination	2.55	$1.28 \times 10^1$

*Note.* The Delta BIC and BF for each model were computed with respect to a random choice model. Therefore, higher Delta BIC and BF are indicative of better fit to the Team Task Management choice data. The BF is derived from the Delta BIC. TTB = Take-The-Best model; EW = Equal Weight model.

**Table 10 - Percentage of participants for which the indicated Models were definitely a stronger fit to the Team Task Management choice data than a random model (top row).**

Models compared to a random choice model
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	Policy	TTB Cohesion	EW	TTB SMM	TTB Coord'n
<b>Definitely a stronger fit</b> in favor of the <b>indicated model</b> over a random choice model (Definitely a stronger fit in favor of a random choice model over the indicated model)	38% (1%)	30% (2%)	12% (3%)	8% (4%)	3% (5%)
<b>Possibly a stronger fit</b> in favor of the <b>indicated model</b> over a random choice model (Possibly a stronger fit in favor of a random choice model over the indicated model)	12% (3%)	12% (2%)	18% (4%)	5% (4%)	6% (5%)
<b>Hardly a difference in fit</b> between the model and a random choice model	46%	54%	63%	79%	81%

*Note.* Model fit criterion was the Bayes Factor (BFs) for comparing the fit of each of the indicated models to a random choice model. The categories selected for indicating a comparison of goodness of fit between models are based on Jeffrey's classification method of BFs. The top category includes BFs >150 or <0.007, the middle category includes BFs in the ranges of 10-150 or 0.007-0.1, and the bottom category includes BFs within the range of 0.1 to 10. The important row to consider for the current study is the top row, which indicates the percentage of participant for whom the indicated policy fit the Team Task Management choice data at least 150 times better than a random choice model.

#### 2.8.12 Summary: Bayesian Model Comparison

In summary, the first set of analysis indicated that the Policy Model and the TTB Cohesion fit the data equally as well, and the second set of analysis indicated that each of these two models are a strong fit to actual team task switching choice data (as compared to a random model). Together, these precise methods of determining model fit provide

further evidence for the critical role of Cohesion in team selection preferences in the context team task management scenarios employed to study decision-making and strategy use in a multiple team membership context.

## **2.9 Study 1 Discussion**

Study 1 posed the question: What is the relative impact of three team factors (cohesion, cognition, and coordination) on individuals' attraction to working on a particular team? Overall, the findings suggest that, although all three team factors influence team attractiveness ratings, cohesion stands out as the most influential team factor.

Previous studies that have used policy capturing to extract underlying decision rules (e.g., Batsell & Lodish, 1981; Brehmer & Brehmer, 1988; Cooksy, 1996; Klaas & Wheeler, 1990; Slovic, 1972; Stewart, 1988; Webster & Trevino, 1995) have found that a select few decision criteria tend to predict participant choices significantly more often than other decision criteria. In fact, one decision criterion often rises above the rest. This trend has also begun to surface in the task management literature in studies that identify specific characteristics of work tasks that draw more attention to the task and keep individuals engaged (e.g., Wickens et al., 2015). Although Wickens and colleagues (2015) point out that further research is “necessary to establish at least the relative ordering or dominance of [task] attribute weights [i.e., importance], if not the specific values of those weights” (p. 82), they point to preliminary evidence that *task difficulty* stands out as more influential to task management decisions than other task attributes (e.g., Gutzwiller, Wickens, & Clegg, 2014). Interestingly, Gutzwiller and colleagues (2014) also found that the difficulty of the task that was currently being completed had

different effects on task management decisions than the difficulty of a readily available “alternative task.” Specifically, individuals were more likely switch to an easy (as opposed to difficult) tasks, but were more likely to remain on a difficult (as opposed to easy) task on which they were already working.

In terms of team task management, it seems to be the case that many team characteristics significantly influence participants’ team task management decisions, just as was the case in task management research. This was expected given the strong ties between team performance and Team Cohesion (e.g., Carron, 1982; Festinger, 1950; Lewin, Lippitt, & White, 1939; Levine & Moreland, 1990; Mullen & Copper, 1994), Team Coordination (e.g., Ancona & Chong, 1992; Harrison et al., 2003; Marks et al., 2001; McGrath & Kelly, 1986), and Team SMMs (Cannon-Bowers & Salas, 2001; DeChurch & Mesmer-Magnus, 2010; Entin & Serfaty, 1999) in the teams literature (e.g., Kozlowski & Ilgen, 2006). Furthermore, as was the case in the task switching literature, one factor (Team Cohesion) stood out among the rest as more influential in most cases. Specifically, the inferential and descriptive statistics from Phase 1 of Study 1 and Study 2, and the cluster analysis from the exploratory analysis, showed that: (1) Cohesion significantly influenced team attractiveness judgments (and, subsequently, team task management choices in a scripted scenario) for the greatest percentage of participants, and (2) two out of three “policy profile” groups (that described how participants utilized all three cues together) contained 100% of participants for whom Cohesion significantly influenced their judgments, which was more than any other team factor.

The findings that multiple team factors influenced team task management decisions, but one team factor stood out above the rest did not come as a surprise given

similar findings in the task management literature. These parallel findings for team factors and task attributes are supported by basic research in human cognition in the areas of strategies and decision-making. In preferential choice task situations (i.e., when individuals are presented with many alternatives and are forced to choose one), individuals tend to employ particular decision policies that are robust across many application areas. For example, individuals operating in an overloaded situation often use heuristics (i.e., compensatory decision strategies; e.g., Gigerenzer, 2008; Shah & Oppenheimer, 2008) such as basing their decisions on one factor that has worked well to differentiate their choices in the past (i.e., the “take-the-best” heuristic; e.g., Hassall & Sanderson, 2014). In the case of team task management, my findings suggest that individuals may use a decision strategy similar to the “take-the-best” heuristic by selecting a team based on the level of cohesion exhibited by that team, while paying less attention to the other team factors.

Because this was the first study to investigate how individuals may choose between different teams in a scripted team task switching scenario, there was no body of literature to suggest *which* team factor would stand out amongst the others as the most influential. It was expected, however, that team-related factors would play a role in how individuals decided between team tasks. Mortensen and colleagues’ (2007) showed that individuals spend more time working on one team’s task than all other teams, even after controlling for the type of tasks that are performed. However, they did not offer an explanation as to the team factors that influence this disproportionate distribution of time to the greatest extent. In other words, there are characteristics of teams that do influence



task management decisions beyond characteristics of the tasks themselves, but researchers had not previously systematically investigated these factors.

In terms of the proposed hypotheses, each of the three team characteristics tested had a strong relationship with team task management in the hypothesized direction for at least one third of all participants in Phase 1. This positive trend was also seen in Phase 2, although the number of significant cases for each factors dropped considerably, likely due to the fact that there were twice as many factors competing for attention. These combined analysis offer support for hypotheses 1a (Team Cohesion is positively related to team task attractiveness), 3 a and b (Team Coordination is positively related to team task stickiness and attractiveness), and 4 a and b (Team Cognition is positively related to team task stickiness and attractiveness). With regards to hypothesis 1b (Team Cohesion shares an inverted “U” relationship with team task stickiness), given the strong, positive *linear* relationship observed between current team cohesion and the likelihood of remaining on the team (i.e., it was the most influential factor among the 6 tested), the hypothesis would need to be revised to read “Team Cohesion is positively related to team task stickiness.”

My findings suggest that cohesion shares a strong, positive relationship with both team attractiveness (alternative team) and stickiness (current team), which was not expected. I expected to find a non-linear relationship between cohesion and attractiveness to alternative teams such that low cohesion and high cohesion teams would be viewed as less attractive, whereas teams with moderate cohesion would be viewed as highly attractive. This expectation was based on qualitative evidence from teams literature suggesting that working on highly cohesive teams could lead to the inability to leave the

team to fulfill other obligations (e.g., Crawford & LePine, 2013), which could be especially problematic when individuals are members of multiple teams with whom that have made multiple commitments (e.g., Mortensen et al., 2007).

One possible explanation for this unexpected finding is that the appeal of working with teammates who are constructive, encourage sharing unique perspectives, and engage in collective problem solving and decision making (i.e., a highly cohesive team) may cover up the underlying limitations of working on such a team (i.e., the inability to fulfill other commitments). The reason for this may be two-fold: (1) individual decision making processes are constrained by a limited working memory capacity, and (2) in overloaded situations, individuals typically default to processing “surface-level” characteristics. Due to limitations of long-term memory and working memory, individuals process a subset of all available information when making a decision (i.e., bounded rationality; Paas & Sweller, 2012). Furthermore, in an overloaded situation, individuals often consider surface-level characteristics at the expense of understanding the deeper complexities of the environment (e.g., Kahneman, 2011). In terms of team task management, the more salient aspects of cohesive teams (e.g., working with constructive members of a team who are committed to accomplishing a shared goal) may make the team appear more attractive when considered at face-value, but the restrictive nature of these ostensibly positive characteristics (e.g., feeling obligated to remain with the team until the goal is completed in spite of other personal obligations) may not be considered. Indeed, In the case of team task management, this would mean failing to consider the consequences of focusing entirely on one team at the expense of one’s commitments to all other teams. Understanding such complex relationships without actually experiencing them (i.e.,

reading a team task switching scenario) requires one to engage in the resource-intensive exercise of mental simulation (e.g., Kahneman & Tversky, 1982; Wells & Gavanski, 1989), which would be prohibitive in an overloaded situation. Specifically, individuals would have to imagine the experience of being “stuck” on a highly cohesive team, and the implications that might have on one’s commitments to their other teams. Such an approach is uncommon in overloaded situations (e.g., Katidioti & Taatgen, 2014) in which a deluge of information consumes the cognitive resources required for deeply processing decision making cues.

### *2.9.1 Threats to Validity*

There are possible threats to validity for the findings of Study 1. First, internal validity speaks to the soundness of the design of the experiment itself in terms of controlling for confounding variables that lead to systematic variance that is not attributable to the independent variables (e.g., Shadish, Cook, & Campbell, 2002). One possible threat to internal validity is the selection of team scenarios in Phase 2 of the study to represent comparisons that would differentiate different decision strategies. Previous policy capturing studies have used fractional designs to deal with the problem of participant fatigue, while still allowing the researcher to incorporate most (if not all) scenarios into the analysis. However, due to the large number of variables investigated in this study, as well as the theoretical motivations behind creating certain comparisons, I decided that the information obtained from restricting the comparisons was worth the risk that specific combinations would not be represented in any of the participants. Furthermore, this approach allowed me to calculate the reliability of strategies utilized

within each of the groups identified in the cluster analysis, which would not have been possible had they all answered different scenarios.

Second, statistical conclusion validity is the extent to which conclusions about the relationships between independent and dependent variables are reasonable (e.g., Shadish, Cook, & Campbell, 2002). In this study, I took a nomothetic approach to analyzing the factor importance weights. In other words, I summed all significant beta weights across regression models, which allowed me to get a sense of which factors stood out above the rest while considering the entire sample as a whole. As noted in the additional exploratory analysis, I also used an idiographic approach to identify more granular patterns in the data that addressed the concern of interdependencies between team factors. This additional analysis identified systematic dependencies between team factors that gave rise to decision “profiles” used by groups of individuals. Taken together, these two approaches provide a more complete picture of how individuals utilize the team factors, but one must be careful when describing the relationship between the independent (team factors) and dependent (team attractiveness) variables.

Third, construct validity is the degree to which a study measures what it claims to measure (e.g., Shadish, Cook, & Campbell, 2002), specifically focusing on both the independent and dependent variables as well as the relationships between variables. The focal team constructs of this study (i.e., the independent variables) were Team Cohesion, Team Coordination, and Team Shared Mental Models, and descriptions used to represent these constructs were selected based on the results of a construct validity study. However, it is important to note that respondents were forced to choose between the three focal team constructs, and only these three constructs, when rating the team descriptions. In

other words, if the descriptions were, in fact, better representations of other constructs not tested (e.g., Psychological Safety; e.g., Baer & Frese, 2003), it would not have been captured in the study. This was a necessary limitation as it would be prohibitive to list every construct related to social interactions, but it does raise the possibility that respondents rated descriptions as representing a particular team construct simply because a better options was not available.

For example, although the description that was found to best represent high Team Cohesion was “*The team provides a safe, comfortable environment to openly share ideas,*” which aligns with current definitions of Team Cohesion (e.g., Mullen & Cooper, 1994), this statement could have also been indicative of high Psychological Safety (e.g., Baer & Frese, 2003). Gibson and Gibbs (2006) define Psychological Safety as “an atmosphere within a team characterized by open, supportive communication, speaking up, and risk taking” (p. 455). Although the two constructs of Cohesion and Psychological Safety are similar in that they both describe team environments in which members feel comfortable working with one another, some definitions of Cohesion include other aspects of the construct that are brought about through a teams interactions within this shared environment. For example, Festinger (1950) describes other aspects of working on cohesive teams, such as a sense of pride in the team and a commitment to team tasks, that may also factor in to how attractive or sticky a team may be. Because these aspects of Festinger’s (1950) definition of Cohesion are not immediately apparent in the Cohesion statement used in this study, the performance benefits of working on a Cohesive team may not have been factored in to one’s perceptions of how attractive and sticky that team may be.

Similarly, the focal constructs of Team Shared Mental Models (SMM) and Team Coordination both share similarities with different facets of the construct of Team Situation Awareness (Team SA; Cooke, Gorman, & Rowe, 2009; Gorman, Cooke, & Winner, 2006). The description that was found to best represent high Team SMM was *“Team members are always ‘on the same page’ when asked about aspects of the task or how it is being carried out.”* which aligns with current definitions of Team SMM (e.g., DeChurch & Mesmer-Magnus, 2010). The description that was found to best represent high Team Coordination was *“Team member actions are tightly synchronized with the other members of their team.”* which aligns with the current definitions of Team Coordination (e.g., Marks et al., 2001). However, Team SA, a construct in the Human Factors literature, is “theoretically linked” (Cooke, Gorman, & Rowe, 2009, p. 163) to SMM in that “a shared mental model – or a long-term understanding of the task, team, or equipment on the part of the team – is thought to be an important factor in Team SA, and specifically in the construction of a team situation model (Cooke, Stout, & Salas, 2001)” (Cooke, Gorman, & Rowe, 2009, p. 163-164). Furthermore, a by-product of strong Team SA is a highly coordinated team (e.g., Gorman, Cooke, & Winner, 2006). These examples illustrate how the two focal constructs of Team SMM and Team Coordination could be conflated with Team SA depending on whether one is describing the long-term, relatively stable state of a shared understanding with one’s teammates (Team SMM) or the tightly synchronized behaviors (Team Coordination) that result from this shared understanding.

One possible explanation for the apparent lack of clear divisions between the focal team constructs and other constructs not considered in this study is that research on

teams is relatively sparse compared to other more established psychological disciplines. As with any burgeoning discipline, teams research continues to explore the boundaries between constructs such as Team Cohesion, Team Coordination, and Team Shared Mental Models so that causal relationships between these constructs and various outcomes can be more clearly defined (e.g., Hackman, 2012). Although these are fruitful efforts given the prevalence of teamwork in today's work environments, the somewhat nebulous definitions of the focal constructs make it difficult to ensure that all of the independent variables that could affect the outcome of the study are accounted for. Additionally, because the statements used to represent the team constructs in the Policy Capturing scenarios were necessarily limited to one short sentence, a complete representation of all aspects of each of the currently accepted constructs was not possible.

In addition to possible construct validity issues with the independent variables, the methodologies used in the Policy Capturing are atypical, and could call into question the observed relationships between the independent variables and the dependent variables. Specifically, in Policy Capturing, the experimenter uses written scenarios to represent actual experiences, which may be viewed as problematic to some. For example, does reading a scenario represent one's intentions for what they believe they would do in the situation, or can it serve as a proxy for actual behavior? This is a valid concern that is still a topic of debate for those utilizing the policy capturing technique (e.g., Aiman-Smith, Scullen, & Barr, 2002). One alternative approach would be to have individuals watch short video scenes of the team members who exhibited the intended construct and then answer questions regarding team attractiveness. Although this approach may provide an experience that would be closer to actual interactions with team members, the amount of

time required to convey three levels of Team Cohesion, Team Coordination, and Team SMM in team video vignettes across 27 scenarios would be prohibitive. Additionally, this approach would introduce a number of additional factors that would need to be controlled across all scenarios (e.g., non-verbal cues, demographic compilation of team members), which would likely increase the amount of error variance in the resulting data.

Fourth, external validity is the extent to which results obtained in the study can generalize to others in the population of interest outside of the study (e.g., Shadish, Cook, & Campbell, 2002). For this study, the population of interest is all individuals who work with multiple teams for at least part of the workday. To help ensure that the respondents in the Policy Capturing study were representative of this population characteristic, respondents who selected “All of my work is independent; I am capable of doing all, or nearly all, of my work without relying on others.” were screened out of the study. However, respondents who indicated that most of their work was completed independently, but they occasionally worked with multiple teams, were permitted to continue with the study. Respondents who only occasionally work with teams may have very different experiences than individuals who always work with teams, and results from those respondents may not necessarily generalize to the population of interest.

### *2.9.2 Limitations*

In order to remain within the acceptable number of scenarios read by participants in a Policy Capturing study (e.g., Cohen & Cohen, 1984), only three focal team constructs could be investigated. These three team constructs (i.e., Team Cohesion, Team Coordination, or Team SMM) accounted for a great deal of variance in participant answers. However, results indicated that there were still factors contributing to



respondents' answers that were not attributable to these three constructs. If I would have been able to include additional constructs in the Policy Capturing study, I may have identified additional team factors that significantly influenced the team task switching decisions observed in the study. Furthermore, I could not include team constructs similar to Team Cohesion (i.e., Psychological Safety) and Team Coordination and Team SMM (i.e., Team SA) to test for possible confounds resulting from conflating similar constructs.

The main limitation of Study 1 was that I drew inferences from decisions made from scripted scenarios (i.e., “paper people”). Although this methodology afforded me the ability to test many different variables in one study, the likelihood that the results would translate to behavioral observations in similar situations was not entirely certain. Furthermore, there is no easy way to include veridical representations of bottom-up cues, such as a message from a teammate, in the scripted team task switching scenarios. For this reason, the policy capturing technique is limited in large part to “top-down” representations of the scenario being described. Study 2 was designed to remedy this limitation by observing participant behavior in an actual team task switching experiment, where bottom-up factors were present.

### *2.9.3 Using the Results of Study 1 to Inform Study 2*

Results of Study 1 indicated that Cohesion was the most important team factor in team task management decisions. Therefore, in Study 2, I conducted a laboratory experiment in which I manipulated team Cohesion across teams such that participants switched between teams that were high on team Cohesion and teams that were low on team Cohesion. Whereas Study 1 results were based on participants' meta-cognition for

how they would make decisions in a team task management scenario, in Study 2 provided direct observations of participants' behavior in a controlled experiment. Furthermore, whereas Study 1 focused entirely on team characteristics that influence team task management, Study 2 also investigated possible moderating effects of technology on that relationship.

For Study 2, I chose to conduct a within-subjects, crossed design (with two independent variables: Team Cohesion and Technology Affordance) in which participants carried out tasks in 8-minute trials with confederate teams (i.e., research assistants) within a virtual collaboration environment. There were several reasons for carrying out the laboratory study in this way. First, this design allowed for the careful and systematic control over Team Cohesion and the Technology Affordances used while carrying out the tasks. Should I have used another design, such as a longitudinal design or a team of participants (as opposed to using confederates for team members), it is likely that other team factors would have naturally developed between members, and it would have been difficult to disassociate possible observed effects of one construct versus another. For example, teams research has shown that team states co-evolve as teams work together over time (e.g., Arrow, Poole, Henry, Wheelan, & Moreland, 2004; Marks et al., 2001), so it would be highly likely that teams working together within a study would develop not only a state of Cohesion but would also likely develop a shared understanding of the task and teamwork required to carry out the task (i.e., SMMs). SMMs could have also influenced team task management decisions, so in the absence of systematic control over one construct while varying the other, it would be difficult to see the direct effects of each. Furthermore, the notion that team factors “co-evolve” may also

call into question any conclusions made about team task management based on the observed behavior. For example, it is possible that teams with higher Cohesion develop stronger SMMs than low cohesion teams as a result of this cohesive state. Therefore, it may have been problematic to allow the team states to develop naturally and then statistically remove the effects of one factor to observe the direct effects of another because in doing so you could run the risk of changing the relationship of the remaining factor (i.e., an interaction effect). This would not necessarily be problematic in a study that focused on the complex relationships between co-evolving factors. However, the goal of the current study was to investigate the most important team factor in team task management in order to enable the development of targeted interventions to increase time spent on critical team tasks.

Second, I observed the switching behavior of *one* team member across multiple teams, and “controlled” the switching behavior of other team members using confederates. Alternatively, I could have recruited multiple participants to serve on the team and designated one member to switch, while instructing all other team members to remain on the team for the entire session. However, this would have likely artificially changed the Cohesion of the team members who were “forced” to remain on the team, possibly leading to a sense of shared identity with those team members and engendering a sense of ingroup members (the intact team) versus outgroup members (the switching team member) due to these artificial boundary lines. This would have likely introduced an additional confound because the state of Cohesion of a team may be experienced differently by the individual switching than the other members of the intact team. On the other hand, allowing all participants to switch freely between teams would make it

difficult to define boundaries between intact teams so that Cohesion could be effectively measured.

Third, I used a virtual collaboration tool (Google docs) to carry out the study. This allowed for strict control over the type and frequency of communication from the confederate team members to the participants, and for the manipulation of the Technology Affordance factor. Furthermore, recent research has demonstrated the increasing pervasiveness of the use of virtual collaboration tools for team meetings (e.g., Jaspersen, Carter, & Zmud, 2005), so this approach increased the ecological validity of the study, because individuals often collaborate virtually in Multiple Team Membership environments (e.g., Mortensen et al., 2007).

# **CHAPTER 3. STUDY 2: IMPACT OF SOCIAL TECHNOLOGICAL FACTORS ON TASK STICKINESS & ATTRACTIVENESS: A TEAM TASK MANAGEMENT EXPERIMENT**

Results from Study 1 indicated that, in a scripted scenario, team Cohesion was the most important team factor in determining how attractive a team would be to work with when choosing between multiple teams. Although teams research does point to behavioral evidence that team Cohesion does, in fact, increase the level of engagement with one's teammates as well as the level of enjoyment they experience with that team (e.g., Mullen & Cooper, 1994), these findings are based on observations of one intact team throughout the entire team's lifecycle. The context of the current study is modern-day environments in which individuals are members of *multiple* teams at any give time. Therefore, the primary outcome (i.e., dependent variable) of interest is the amount of time spent on teams of varying levels of Cohesion rather than their experience with one team in particular. Specifically, the research question related to Team Cohesion is: How does Team Cohesion affect how much time an individual allocates to various teams in a multiple team membership situation? The related hypothesis is:

*Hypothesis 8: The level of Cohesion within a particular team is positively related to the amount of time that an individual will allocate to that team.*

Because teams are increasingly collaborating over technology platforms, it is also important to understand how various aspects of that technology affect how individuals interact with various teams. Specifically, in virtual teaming environments, the perception of team Cohesion may change as a result of how teams are represented to the team members. In the case of team Cohesion, permanent records of individual members communicating with one another (i.e., persistent person-to-person association affordances) that are infused with affective comments between team members (e.g., “We’re all in this together!”) provide members with proximal cues of the level of cohesiveness within the team. For example, chat functions that provide a permanent record of all previous communications between team members and are visible to all members as they complete the task provide a salient reminder to each member of how well team members are getting along. In the absence of these cues, members may not consider team Cohesion as often when making decisions about how to allocate their time across multiple teams. Therefore, the second research question explored in Study 2 is: How might persistent person-to-person association technology affordances change the relationship between team Cohesion and time allocated to that team? The related hypothesis is:

*Hypothesis 9: Persistent person-to-person association affordances strengthen the relationship between team Cohesion and the amount of time that an individual will allocate to that team.*

### 3.1 Method

#### 3.1.1 Participants

Thirty undergraduate participants were recruited through the Georgia Institute of Technology SONA online psychology experiment scheduling service. However, due to recording technology failures, data from 3 participants were not usable, yielding a total sample size of twenty-seven participants to be used for analyses. According to a power analysis using an estimated effect size of Cohen's  $f = 0.3$ , statistical power of 0.95, and  $\alpha = .05$ , a sample size of twenty would have been appropriate for this design, so twenty-seven participants was adequate to identify any significant differences between conditions should they exist in the population. The literature does not indicate an appropriate effect size for team task management in terms of differences in time allocated to each team because research does not exist in this area. Therefore, this medium effect size was chosen because small differences in the amount of time allocated to various teams may not be informative in terms of practical applications of findings. On the other hand, setting the effect size too large may lead to a failure to capture a meaningful difference in the distribution of time between the teams.

#### 3.1.2 Procedure

**Virtual teams.** In this study, all teams with which participants interacted were virtual. Specifically, participants interacted with these teams entirely over the computer. All task work was performed over a shared document, and any communication with the teams occurred over text-based chat functionality or by typing communications directly in the virtual, synchronous document. This approach allowed for all of the “teams” with

which participants interact to be made up of confederates (see the following subsection for details), which allowed for control over possible confounding variables (e.g., teams of participants that never reach a cohesive state during the limited session time) and addressed the fact that it may be prohibitive to recruit two teams of participants to obtain one data point from a “team task switcher” participant. Furthermore, teams in today’s organizations and institutions are becoming more virtual, so this design supported ecologically valid findings that could generalize to a number of modern-day organizations and academic institutions.

**Confederates as team members.** In the proposed study, research assistants served as confederate teams. Specifically, as participants interacted with their “teams” over the computer interface, the research assistants responded to participants and carried out the team tasks as if they were two different teams interacting with the participants. To reduce possible confounds resulting from experimenter bias, responses typical of each team of interest (e.g., responses typical of a highly cohesive team) were carefully scripted so that the confederates knew exactly how to respond when interacting with the participant. Specifically, the confederates copied and pasted responses from two lists of responses (i.e., one for the team Cohesion high condition and one from the team Cohesion low condition) based on the nature of the question from the participant.

**Content validity test for team cohesion scripts.** I conducted a content validity study to ensure that the comments that confederates copied and pasted when interacting with participants were valid representations of high Cohesion and low Cohesion teams. I tested 75 comments that teammates from teams of varying levels of cohesion may say to one another when working together to solve a task. Specifically, 25 comments were



constructed to represent low Cohesion teams, 25 comments were constructed to represent somewhat Cohesive teams, and 25 comments were constructed to represent high Cohesion teams. Two groups of respondents (“experts”; 16 teams researchers from various universities, and “novices”; 65 Georgia Tech undergraduates) read each of the 75 comments and rated the cohesiveness of the team in which the statement was made as “not at all cohesive,” “somewhat cohesive,” or “very cohesive.” Respondents were provided a definition of team Cohesion, which appeared at the top of every page for their reference. The goal of this content validity study was to identify twenty-four total statements to be used by the experimenters in the lab study: 12 statements for “low Cohesion” teams and 12 statements for “high Cohesion” teams. These statements needed to be (1) valid indicators of the level of cohesion that they were intended to represent, and (2) able to be used in a wide range of conversations as experimenters interacted with participants. A total of twenty-four statements were chosen to ensure that there were enough statements for experimenters to use across the four experimental trials, given the timing specifications described in a subsequent section of this manuscript.

To analyze the validity of the team Cohesion statements, I conducted chi-squared tests to ensure that a significant percentage of respondents (in both the “expert” and “novice” respondent groups) indicated that the statement was indeed coming from a team with the intended level of Cohesion (either a high Cohesion team or a low Cohesion team). Only those statements that a significant majority of respondents marked as coming from high Cohesion teams ( $p < 0.01$ ), and statements that a significant majority of respondents marked as coming from low Cohesion teams ( $p < 0.01$ ) were considered. Of these statements, I selected 12 “high Cohesion team” and 12 “low Cohesion team”

statements that could be used in a wide variety of situations as experimenters interacted with participants. See Table 11 for all statements that met the content validity criteria and were used by experimenters in the laboratory study.

**Table 11 - Team Cohesion statements used by experimenters in Study 2 (i.e., the laboratory study)**

<u>Level of Team Cohesion</u>	<u>Team Statement</u>
High Cohesion Team	<i>We're all in this together!</i>
High Cohesion Team	<i>I like how we are working together so well.</i>
High Cohesion Team	<i>I wouldn't want to do this with any other team.</i>
High Cohesion Team	<i>We're definitely the best team.</i>
High Cohesion Team	<i>We're on a roll... Let's keep it up!</i>
High Cohesion Team	<i>I think we are doing an awesome job!</i>
High Cohesion Team	<i>That sounds great, let's do that!</i>
High Cohesion Team	<i>Go team!</i>
High Cohesion Team	<i>We are going to ace this thing!</i>
High Cohesion Team	<i>Well done everyone!</i>
High Cohesion Team	<i>We're going to make it!</i>
High Cohesion Team	<i>Let's stick together on this and get it done.</i>
Low Cohesion Team	<i>I have to go work with another team.</i>
Low Cohesion Team	<i>I would rather do this with another team.</i>
Low Cohesion Team	<i>I don't really like working with y'all very much.</i>
Low Cohesion Team	<i>We are way behind - let's just stop here and be finished.</i>
Low Cohesion Team	<i>We're not getting this at all.</i>
Low Cohesion Team	<i>Why do I care about this again?</i>

Low Cohesion Team	<i>This is taking forever... it's miserable.</i>
Low Cohesion Team	<i>I think we are going to fail miserably at this task.</i>
Low Cohesion Team	<i>There's no way we are going to finish this.</i>
Low Cohesion Team	<i>I don't think we are doing well at all on this task.</i>
Low Cohesion Team	<i>No, that doesn't sound good to me at all.</i>
Low Cohesion Team	<i>I really don't like this.</i>

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*Note:* These statements were found to be valid representations of team Cohesion at the intended level of the construct, and not valid representations of other team factors.

**Team task.** The team task that the participants performed with the “confederate teams” was a survival task in which the participants were provided a list of 15 items (along with the “team”) that the team might use in a survival situation. The team’s task was to order the items on the list according to their importance to one’s survival as described in the particular scenario. The teams accomplished the ordering of items by entering them on a “worksheet” that followed the survival task scenario on the Google doc. Specifically, the worksheet was composed of two columns. The left column listed all 15 items, and the right column was composed of empty cells in which participants and their confederate teammates typed in numbers next to the items (see Appendix A). These numbers represented the respective item’s rank in terms of how important the item was to their survival. Participants worked with their confederate teammates by communicating entirely through the Google doc in accordance with the Technology Manipulation condition (i.e., chat function absent versus chat function present). Any communication that was sent through the Google doc was sent instantaneously.

The same structure of the survival task was repeated across conditions, but the scenarios and survival items varied across conditions. In other words, although

participants received the same survival tasks in trial 1 and trial 2, the conditions were counterbalanced across trials (in terms of the technology affordance), so half the participants completed the first set of three survival tasks in the chat present condition, and half of the participants completed the first set of three survival tasks in the chat absent condition. Participants received the following survival tasks along with the associated list of survival items in trial 1 of the study: Jamestown disease, Alaskan wilderness, and Canada plane crash. Similarly, participants received the following survival along with the associated list of survival items in trial 2 of the study: Moon survival, Colorado hiking, and Desert survival. See Appendix A for all of the survival tasks and associated survival items used in the study.

Participants worked with two teams on two team tasks (each team had their own team task in their own respective Google doc) throughout each trial, and participants could move freely between the team tasks. Participants were not required to work on the tasks until they were complete, but rather worked with their teams on the tasks until the 8-minute trial had ended. Participants were notified of the end of a trial by a message in a pop-up window that read, *“Your task is now complete. Please stop working on the task immediately and wait for the experimenter.”*

When participants switched away from a team task (i.e., clicked on another Google doc), the confederate members of that team continued to work on their team task and communicate with one another according to the communication schedule (described in a subsequent section) while the participant was away. If one of the confederate team members sent a message to the team when a participant was working with a different

team in another Google doc, the participant was not able to see the message until they returned to the original team's Google doc.

**Participant training and instructions.** A training session preceded experimental trials. During this training session, participants watched a video that provided instructions for the tasks that they would complete, the tools that they would use to complete the tasks (i.e., the Google Docs and communication tools within those Docs; see Appendix B), and the “virtual teams” on which they would be members. In this video, participants were informed that they were members of two different teams working to accomplish tasks, and they also had a third, independent task to complete as well. The independent task was added to ensure that participants could leave one team if they wished without being forced to work on the other team. In other words, the individual task provided a way to ensure that participants were making the choice to work on one of the teams of their own volition. They were instructed not to prioritize any one task over the other (either of the team tasks or the individual tasks), but to consider all three equally as important. They were shown how to switch between the three tasks by clicking on the tabs at the top of the Google Doc window to view each of the team tasks and the individual task, and were instructed to move freely between the tasks as they wished throughout the trial. The two teams could also be distinguished by the names of the team members (e.g., Bravo 2 and Bravo 3) working within each of the team task Docs. If participants chose to switch team (or individual) tasks, they simply clicked on a tab and worked on that task for as long as they wished before moving to another task.

In the training videos, participants were also told that there were two ways in which they would be interacting with their teammates (i.e., technology manipulation). They were

told that the chat function would be active on half of the trials, and would not be active on the other half, and that the experimenter would adjust these settings accordingly before the trial. They were strictly instructed not to adjust the chat function settings during trials, and it was verified during the trials that participants did not adjust these settings. For the trials in which the chat function was not enabled, participants were instructed to type directly in the Google Doc to communicate with their teammates, and to delete and then type over any questions or comments from their teammates when responding in turn. In this way, when the chat function was disabled, there was still synchronous communication with team members, but no persistent person-to-person record of the conversation was available to participants. See figure 1 below for examples of a High Cohesion statement and a Low Cohesion statement made within Google Docs in the chat disable condition by a High Cohesion Team and a Low Cohesion Team, respectively.

Item	Ranking
Compress kit (with 28 ft. of 2-inch gauze)	Well done everyone!
Cigarette lighter without the fluid	

Item	Ranking
1 liter of lighter fluid	We're not getting this at all
A deck of playing cards	

**Figure 1 - Screen shots of experimenter (acting as a teammate) interacting with participant in the High Cohesion condition (above) and experimenter (acting as a teammate) interacting with participant in the Low Cohesion condition (below) within Google Docs. Screen shots are from the Chat Absent technology condition, so**

**experimenters and participants are typing to one another directly within the Google Docs, and not using the chat function. Comments made by the experimenter (serving as a teammate) in the High Cohesion condition are outlined in green in the top image for emphasis, and comments made by the experimenter (serving as a teammate) in the Low Cohesion condition are outlined in red in the bottom image for emphasis.**

After participants watched the training video, the experimenter answered any questions that the participants had about the training and then began the team practice tasks (which also served as the start of the team Cohesion manipulation).

**Team cohesion manipulation.** Next, participants performed practice tasks with the two teams which served two purposes. First, participants watched a 9-minute video that contained instructions on how to complete the survival tasks, how they would switch between team and individual tasks, and how to use the different tools available to them in the online collaboration document. Participants were shown these training videos before beginning experimental trials to minimize the possible impact of a learning curve during the early trials. Second, participants were exposed to the levels of Cohesion of the two teams with whom they would be working during trials so that they could enter the first trial with an understanding of the level of Cohesion present on each of their two teams. The team Cohesion manipulation was implemented by copying and pasting the appropriate scripted comments (that can be found in a previous section) in the appropriate team's Google Doc. Specifically, excerpts validated for "High Cohesion Teams" were used for one team with which the participant interacted, and excerpts validated for "Low Cohesion Teams" were used for the other team with which the participant interacted. During the 8-minute practice task (and during each subsequent 8-minute trial), experimenters copied and pasted eight cohesion-related statements for each of the two teams that were specified for each particular trial (so that phrases were not repeated on

subsequent trials). Additionally, experimenters had a word bank of “neutral” phrases related to the task itself and “neutral” responses to questions that naturally came up in the course of interacting with participants (see Appendix C for the complete list of “neutral” statements available to experimenters). On average, experimenters interacted with participants once every 30 seconds, and used one of the cohesion-related statements once every minute throughout the 8-minute practice session and trials. See Appendix D for a sample of a complete chat log between a participant and the two teams (i.e., experimenter acting as teams) during a trial.

**Experimental trials – Team cohesion manipulation.** After participants completed the training portion of the session, they began experimental trials. Each participant completed two 8-minute experimental trials in which they worked on tasks with one High Cohesion Team, one Low Cohesion Team, and one independent task. Each task switch, along with the time stamp in which the switch occurred, was recorded using Morae software (see Appendix F) so that the total amount time spent on each team task and individual task could be calculated for each participant on each trial. The proportion of time allocated to each of the three tasks was the main dependent variable of interest in Study 2. The sessions were video and audio recorded should the recordings be needed to verify that participants were actually completing the tasks as directed.

Participants were notified of the end of the first trial using a pop-up window that read, *“Your task is now complete. Please stop working on the task immediately and wait for the experimenter.”* Next, experimenters set up the second trial for the participants and let them know when they could begin. The same process was repeated for the second



trial, with the exception of the technology manipulation. Participants switched the technology setting for the second trial.

***Team cohesion manipulation check.*** After completing both trials (i.e., at the end of the session), participants filled out a manipulation check survey to ensure that the Low Cohesion team and the High Cohesion team were perceived as such to the participants. The survey questions referred to specific trials within the session and included team member names from each of the teams with which they interacted in the following format: “In the [session half] half of this session, how cohesive was the team in which [team member names] were your teammates?”. Participants then responded on a 7-point Likert-type scale ranging from 1 = “Not at all cohesive” to 7 = “Very cohesive.” Additionally, the definition of Team Cohesion was provided at the top of every page for their reference. A paired sample t-test showed that participants rated the High Cohesion teams significantly higher on Cohesion ( $M = 5.70$ ) than the Low Cohesion teams ( $M = 2.19$ ) ( $p < .001$ ). These results indicated that participants did, indeed, perceive the High Cohesion teams as being significantly more cohesive than the Low Cohesion teams.

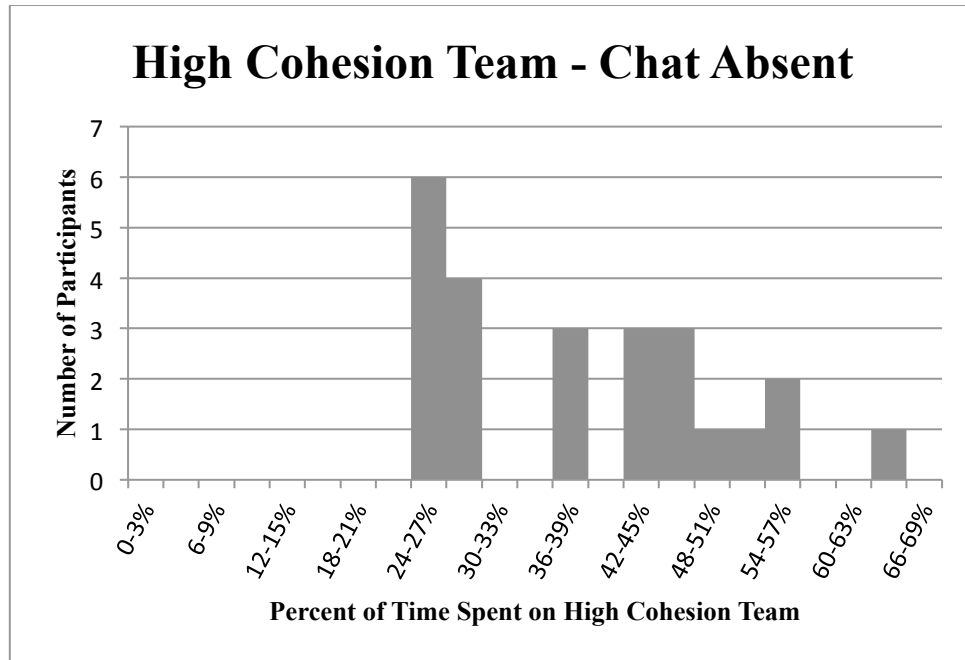
**Experimental trials – Technology manipulation.** For the first half of experimental trials, participants completed the team task with either technology affordance present (i.e., chat function allowing for persistent person-to-person association affordances) or technology affordance absent (i.e., chat function disabled) (counterbalanced across all participants). For the second half of experimental trials, participants completed the team tasks in the opposite technology affordance condition than they started the trials.

### *3.1.3 Experimental Design*

The experiment was a 2 x 2, Team Cohesion (high, low) x Chat Function Affordance (present, absent) factorial design with both variables within subjects. The dependent measure was the proportion of total time in the trial that the participant spent on the team as calculated by dividing the amount of time spent on that team by the total amount of time spent on all tasks in the trial.

#### *3.1.4 Analysis*

The planned analysis for Study 2 was a repeated measures analysis of variance (ANOVA). However, while testing the assumptions required to be confident in findings yielded by an ANOVA, I discovered a violation of the assumption of normality (Shapiro Wilk test;  $p < 0.001$ ). Specifically, dependent variable data in the High Team Cohesion and Technology Affordance Absent condition were not normally distributed (see Figure 2 for the histogram of data in this condition; see Appendix E for histograms of data in all other conditions, in which data were normally distributed). Therefore, the non-parametric alternative to the repeated measures ANOVA (the Friedman test) was conducted on Study 2 data.



**Figure 2 - Histogram of dependent variable data in the High Team Cohesion and Technology Affordance Absent condition. These data failed the Shapiro Wilks test of normality, thus violating the assumption required to conduct a repeated-measures ANOVA.**

### 3.2 Results

See Table 12 for the descriptive statistics results of the 2x2 design. Cells indicate the average proportion of time spent by participants in each condition.

**Table 12 - Results of the Team Task Management laboratory experiment**

		<u>Team Factor</u> (i.e., Team Cohesion)		<i>Note.</i> Experi mental design
		<u>Low</u>	<u>High</u>	
<u>Technology</u> <u>Affordance</u>	<u>Present</u>	$M = 37.9\%$ ( $SD = 12.7\%$ )	$M = 40.1\%$ ( $SD = 11.1\%$ )	
	<u>Absent</u>	$M = 36.1\%$ ( $SD = 15.2\%$ )	$M = 44.0\%$ ( $SD = 19.1\%$ )	

and descriptive statistics results of the Team Task Management laboratory experiment.

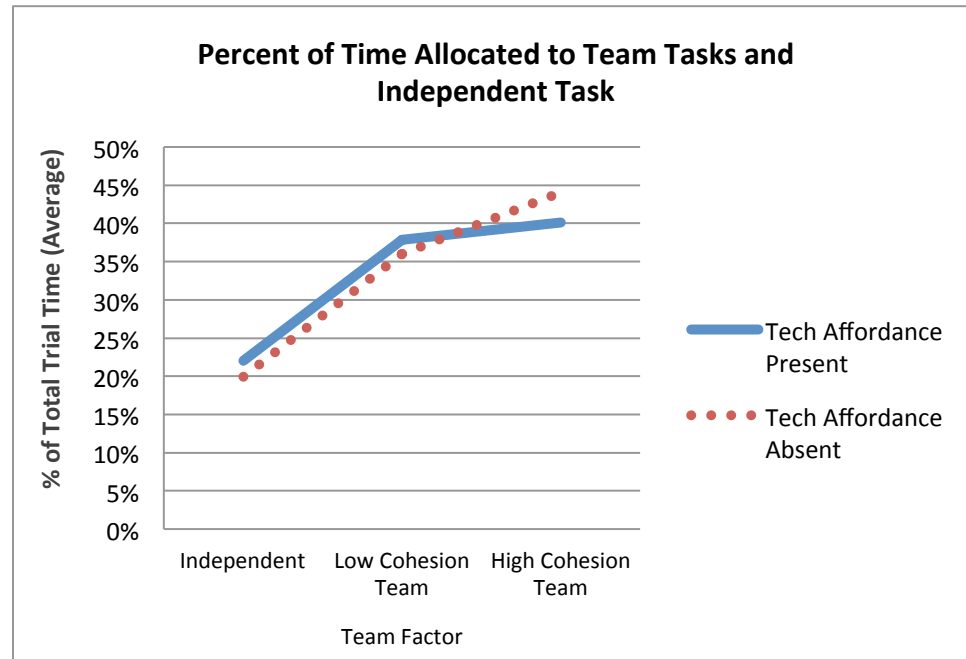
The first independent variable, Team Factor, and the two levels of this variable (Low, High) are indicated by the column labels. The second independent variable, Technology Affordance, and the two levels of this variable (Present, Absent) are indicated by the row labels. Cell values indicate means (in percentage of time) allocated to the team task in the indicated condition (i.e., the dependent variable) along with variance (in standard deviations).

The Friedman non-parametric test of significance yielded no significant differences [ $Q(3,27) = 2.33, p=.506$ ] across all conditions. Therefore, I failed to reject the null hypothesis that the distributions of the dependent variables were equal for the specified conditions. In other words, there were no significant differences in time spent on any team in any technology condition across all conditions. Therefore, the proposed hypothesized main effect of Team Cohesion on team task management behavior, main effect of Technology Affordance on team task management behavior, and an interaction between Team Factor and Technology Affordance were not supported. Possible explanations for why I did not obtain the anticipated results can be found in the discussion section of this manuscript.

### *3.2.1 Exploratory Analysis – Individual Task*

Although the individual task was intended to serve as a mechanism to enable participants the ability to not work on either team task (i.e., to give them complete volition over which team task they preferred to work on and when), I conducted exploratory analysis to understand how participants decided to allocate their time across all three tasks. To this end, I conducted a Friedman test, and included the individual task as another level of the Team Factor variable, thus yielding a 3 x 2, Team Factor (independent, low cohesion, high cohesion) x Technology Affordance (present, absent)

factorial design with both factors within subjects. See Figure 3 for the descriptive statistics results of the 3x2 design.



**Figure 3 - Exploratory analysis adding individual tasks as a level of the Team Factor variable.**

The Friedman non-parametric test of significance yielded a significant difference [ $Q(5,27) = 49.074, p < .001$ ] across all conditions. The associated non-parametric, post-hoc paired-comparison tests (Wilcoxon Matched Pairs tests) revealed that the significant differences underlying the overall difference were between the individual tasks and the team tasks ( $p < .001$  for all individual task versus team task comparisons). The average time spent on individual tasks was 20% and 22% (for technology affordance absent and present, respectively) which was significantly lower than the Low Cohesion Team conditions of 36% and 38% (for technology affordance absent and present, respectively)

and High Cohesion Team conditions of 44% and 40% (for technology affordance absent and present, respectively). No other paired comparisons were significant.

### **3.3 Study 2 Discussion**

Study 2 posed the questions: (1) Does the identified relationship between Team Cohesion and team task switching choices in a scripted scenario generalize to behavioral observations of individuals in a team task switching laboratory experiment?, and (2) If so, does collaboration technology (that allows for person-to-person association affordances) moderate the relationship between Team Cohesion and team task switching behavior?. The goals were: (1) to extend Study 1 to understand how participants actually behave in the context of a representative scenario of multiteam membership task switching, and (2) to understand how technology affordances may change that behavior.

None of the hypothesized relationships between team cohesion and team task management behavior nor technology affordance and team task management behavior were supported by behavioral data collected in Study 2.

#### *3.3.1 Threats to Validity*

The lack of support for the hypotheses in Study 2 prompts a serious consideration of threats to validity. First, internal validity speaks to the soundness of the design of the experiment itself in terms of controlling for confounding variables that lead to systematic variance that is not attributable to the independent variables (e.g., Shadish, Cook, & Campbell, 2002). In Study 2, it is possible that the internal validity of the study may have been compromised by the fact that experimenters were serving as all of the team members with whom a participant was interacting. Specifically, each experimenter was

serving as four team members (two team members on the high cohesion team and two team members on the low cohesion team). Although experimenters followed detailed protocols that specified the timing of communication with participants as well as the scripted excerpts derived from the content validity tests, it is possible that participants could have realized that their teammates were not actual participants. Should this have been the case, participants may have exhibited demand characteristics that led them to place equal importance on each “team” to appease the experimenters.

A second threat to internal validity is the possibility of history effects stemming from the first study to which this study was appended. Due to resource limitations, individuals who participated in this study did so as part of a two-part experimental program that investigated (1) the effect of forced task switching in a multiteam environment, and (2) the present study. It was necessary to carry out all sessions in this order because the forced task switching study required a larger number of sessions. Once the current study reached the number of participants required based on the power analysis, the current study was dropped from the research program and the first study continued. In the first study, participants were members of multiple teams, and were forced to switch from one team to the next on fixed time intervals. Although participants received special instructions after completing the forced switching study to prepare them for the choice switching team task study, it is possible that history effects from the first study compromised the internal validity of the current study. Specifically, because participants had previously performed a number of switches between different teams at fixed intervals, routinized behaviors could have developed such that participants continued this systematic switching behavior in the current study when it was not

required. Should this have been the case, we would have expected to see an equal amount of time in each team, which is what the results showed.

Second, statistical conclusion validity is the extent to which conclusions about the relationships between independent and dependent variables are reasonable (e.g., Shadish, Cook, & Campbell, 2002). Statistical conclusion validity moves beyond statistical tests of significance to look at surrounding data that calls into question one's findings. In the case of the current program of research, the fact that Team Cohesion was found to significantly influence team task management choices in scripted scenarios but not in a laboratory experiment raises concerns that may be problematic. The fact that the findings of Study 1 were robust to many research approaches and analyses suggests that it is unlikely that a type I error (i.e., finding a difference when none exists) occurred in that Study 1, and provides compelling statistical support for the likelihood of a type II error (i.e., failing to find a significant difference when one, in fact, exists) in the laboratory study.

There are a number of factors that can cause such a statistical error, including appropriateness of statistical tests, reliability of measurement procedures, and insufficient sampling procedures. I can be fairly confident that the first two factors were of little concern: (1) because the distribution of the data violated the normality assumption, a nonparametric test was used, which is more conservative than parametric tests and appropriate for the sample data collected, and (2) the Morae software automated the data collection of all participant behavior, including the switching behavior of interest with a temporal resolution on the order of milliseconds. Therefore, insufficient sampling procedures would be the likely candidate for explaining the puzzling findings. However, given the repeated measures design of the study, 20 participants would have been enough



to reach more than 90% power to observe a small effect size of  $< 0.25$  should one exist in the population. This is a conservative calculation because, as previously discussed, a small effect size in the actual population would have little practical significance in terms of understanding team task management behavior. In fact, the post-hoc estimated effect sizes were extremely low for the main effects of Team Cohesion ( $partial \eta^2 = .043$ ) and Technology Affordance ( $partial \eta^2 = .025$ ) and the interaction between the two variables ( $partial \eta^2 = .046$ ), indicating that an extremely large sample size would be required to capture this effect, which would have little to no practical significance. Given these findings, it seems unlikely that there are any apparent statistical conclusion validity issues with the current results.

Third, construct validity is the degree to which a study measures what it claims to measure (e.g., Shadish, Cook, & Campbell, 2002), specifically focusing on both the independent and dependent variables as well as the relationships between variables. This threat to validity may be of the greatest concern for Study 2. Central to Study 2 of this dissertation are possible issues related to the theoretical ideas behind the trait under consideration; Team Cohesion. Team Cohesion is an *emergent* state of teams, engendered by team members through their shared experiences (e.g., Marks et al., 2001). Over time, teammates engage in multiple episodes of conflict resolution, collective goal-setting, and accomplishments of shared goals that shape the state of cohesion from within the team. It is important to note that the goal of this study was not to allow a team to develop Cohesion over time, and then observe the effect of Cohesion on team task management (which would, of course, introduce a slew of confounding variables related to other team characteristics that develop alongside Cohesion), but rather to observe how an individual

who is a member of multiple teams views cohesive teams from the outside. However, this approach possibly contradicts the endogenous nature of the construct itself - one must be part of developing cohesion within a team to experience the impact that that team's Cohesion has on your behavior. In other words, because participants interacted with teams who had already developed a state of team Cohesion apart from them, that cohesive state may have been meaningless to the participant.

This theoretical explanation for the puzzling results observed in Study 2 may also support the significant findings in Study 1. When reading the descriptions of teams in the team task switching scripted scenarios, it is possible that participants thought about how their current work teams might relate to the teams described in the scenario. In fact, participants were asked seven questions about their personal experiences working with teams before reading the team task switching scenarios. The teams that were possibly brought to mind would have had a past history with the participant, and would have developed some level of Cohesion. In this way, reading scenarios in Study 1 about “anonymous” teams may have triggered mental simulations of past experiences with cohesive (or non-cohesive teams) that provided a veridical basis for making accurate judgments about how they would allocate their time across the teams. On the other hand, in Study 2, participants were interacting with teams in real-time that were not teams that they had worked with in the past.

Fourth, external validity is the extent to which results obtained in the study can generalize to others in the population of interest outside of the study (e.g., Shadish, Cook, & Campbell, 2002). One might argue that because participants in Study 1 were undergraduate students and participants in Study 2 were working professionals, the

results from each of the studies could only generalize to the populations from which the participants were sampled. In other words, it may be incorrect to draw conclusions across the two studies because students and professional workers may choose teams differently. However, I would disagree with this claim because the characteristics of teams investigated in this program of research are not specific to any particular discipline or area, but have been found to characterize any and all teams (e.g., Kozlowski & Ilgen, 2006).

### **3.4 Limitations**

As with any empirical study, tradeoffs must be made between the ecological validity of the experimental design and the constraints associated with conducting controlled laboratory studies. For example, my design required one participant to switch between multiple intact teams throughout the duration of the session. To maximize the ecological validity of this scenario, I would have recruited five participants, allowed them to (hopefully) form two teams with the fifth individual serving as the “floating” member of both teams. Not being able to design studies in this manner is a limitation. Although it would obviously be incredibly inconsiderate, and in some regards unethical, to recruit five participants in order to collect a single data point, constructing “confederate” teams introduces a number of limitations. First, as previously discussed, not allowing participants the time to develop a natural state of cohesion with their team members may call into question the construct validity of the study.

Second, because experimenters served as multiple team members for each participant, the experiment necessarily took place entirely in a virtual collaboration environment. Previous teams research has demonstrated that teams interact differently in

virtual environments than they do during face-to-face interactions (e.g., unique information sharing; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011), so it is uncertain whether or not similar effects impacted the results of Study 2. Furthermore, in Study 1, the team task switching scenarios did not indicate to participants that the teams were interacting virtually. Therefore, it is possible that participants read the scenarios to mean that the teams were interacting face-to-face, which may further complicate the comparison between results of Study 1 and Study 2.

Third, Study 2 included external “bottom-up” cues within the context of an actual team task switching exercise that could obviously not be included in Study 1. For example, the most salient external cue for Study 2 was quite possibly the real-time messages that were sent between teammates. Because these cues were not available to participants in Study 1, it is not possible to disassociate the effects of such cues from the effects of the Cohesion of the team itself. In other words, while participants in Study 1 made their decisions entirely based on “top-down” mental models of team cohesion, in Study 2 their decisions were likely impacted not only by the mental model, but the tools they used to interact with the participants, the form in which participants communicated, and so on. Research on task completion illustrates the powerful interaction between top-down and bottom-up aspects of tasks (e.g., Cooper & Shallice, 2000), so it is possible that removing all bottom-up task factors may significantly change the process in which the task is carried out.

Fourth, in Study 2, two (and not three) levels of Team Cohesion were tested. There were two reasons for this decision: (1) findings from Study 1 showed a linear relationship between Team Cohesion and team switching behavior, which could be

captured with two levels of the IV, and (2) adding another level of Team Cohesion would require participants to complete more tasks than may be feasible given the time restraints of the study. However, as previously discussed, removing this “mocerate” level of Cohesion could have been problematic be it is possible that Team Cohesion and team switching behaviors share a non-linear relationship when bottom-up factors are present (i.e., Study 2) than when only top-down factors are present (i.e., Study 1). For example, it is possible that, if a team with a “moderate” level of Cohesion were included in Study 2, participants may have spent more time on that team than either the low Cohesion team or the high Cohesion team. In fact, this would have supported my hypothesis for a non-linear, “inverted-U” relationship between Team Cohesion and time spent on the team. However, without the third data point in Study 2, it is impossible to test for this possible relationship.

Finally, as with any study conducted in a laboratory, the fact that participants were carrying out tasks that were not personally meaningful to them in an unfamiliar environment may have affected their behavior. The survival tasks used in this study did not likely provide any inherent motivation for the participants, which was intentional. I did not want some participants to be more engaged than others simply because the subject matter was more meaningful to them. Of course, this also has the undesired side effect that participants may not put great a deal of effort towards the tasks. Furthermore, completing these tasks in a laboratory setting in which participants knew they were being observed may have created performance anxiety, which would also negatively affect their performance.

### **3.5 Conclusion**

The results from Study 2 did not support any of the hypotheses proposed for the study. It is possible that either: (1) limitations of the Study prevented me from capturing a true relationship that existed in the population, or (2) the effect of Team Cohesion on team task management disappeared when actual team task switching was observed. The limitations of Study 2 would need to be addressed to determine whether or not a difference between one's team task management decisions when reading a scripted scenario versus engaging in multiple team task switching activities truly exists.

## CHAPTER 4. GENERAL DISCUSSION

In today's collaborative and virtually connected work environments, the number of teams with whom knowledge workers can choose to work is notably increasing (e.g., Lu, Wynn, Chudoba, & Watson-Manheim, 2003). As a result, at any given time, individuals are members of multiple teams who are completing multiple collaborative tasks (e.g., Mortensen, Woolley, & O'Leary, 2007). This creates a challenging situation in which individuals must decide how to allocate their limited time across multiple tasks *and teams*. Previous research on Task Management has demonstrated that, in such environments, individuals typically choose to work on some tasks more than others (e.g., Wickens et al., 2013). Whereas this research points to aspects of work *tasks* that influence one's time allocation decisions, it does not address the *social* aspects of working with teams in modern-day collaborative environments: Team Cohesion, Team Coordination, and Team Cognition. The current program of research addresses this gap by advancing the concept of *Team Task Management* (McDonald et al., 2015) to investigate how teams can push and pull individuals towards and away from collaborative tasks.

Although the results from the policy capturing study (Study 1) indicated that individuals were more likely to work on a team with high Cohesion than a team with low Cohesion, the influence of team Cohesion was not actually reflected in participant behavior in Study 2. A possible explanation for this paradox is that participants' beliefs about how they would behave in a team task management situation (as evinced by the

results in Study 1) do not provide the entire picture of how these decisions are made in their actual ecology.

There are many examples in the decision-making literature that highlight the phenomenon that what individuals plan to do in a given situation is not necessarily what they actually do when they are in that given environment, or how they perceive that environment to be (e.g., Altmann & Trafton, 2002; Cooper & Shallice, 2006; Thomas, Dougherty, Sprenger, & Harbison, 2008; Treem, & Leonardi, 2012). This is partly because individuals either underestimate or do not take into account all of the “bottom-up” influences that are present in their environment. For example, in the team task switching scenario, the simple fact that individuals were simultaneously carrying on conversations with two teams, regardless of characteristics of the teams that were having the conversations, could have contributed to the recency and frequency with which the participant brought those team tasks to memory, which is known to attract attention back to those tasks in overloaded, multitasking environments (e.g., Wickens, Hooey, Gore, Sebok, & Koenicke, 2009). Therefore, the fact that the participants were frequently interacting with both teams in a salient, virtual environment could have caused participants’ attention to evenly switch between the two tasks as they were reminded of a previous conversation. These “bottom-up” influences are different from “top-down” factors (e.g., an individual’s mental model of a cohesive team) that were accounted for using the policy capturing approach, and could only influence individual’s task switching behavior when they were actually completing the task. To complicate the situation, task-related decisions have to be made much more quickly in today’s work environments where attention is drawn to many tasks (e.g., Wickens et al., 2013) and teammates (e.g.,



Kozlowski & Ilgen, 2006; Mortensen, Woolley, & O’Leary, 2007) in our increasingly virtual environments (Jasperson, Carter, & Zmud, 2005). Possible time pressures that participants may have imposed on themselves during Study 2 were not present in Study 1, which may have influenced the way in which our decision process are carried out (e.g., Hancock & Weaver, 2007; Katiodoti & Taatgen, 2014).

Operating in fast-paced, multitasking situations does not always allow for the careful deliberation of choosing between preferred ways of carrying out a task (e.g., Durso & Alexander, 2010). Such environments may lead to task completion strategies that are focused on factors other than the social aspects of working on teams. For example, heuristics and shortcuts are often used when working memory capacity is low (e.g., Kahneman, 2011), and cognitive tunneling can cause individuals to focus entirely on certain elements of the task itself (e.g., Jarmasz, Herdman, & Johannsdottir, 2005) at the expense of other social cues that may be occurring around us. In the case of study 2, participants could have ignored the social factors that were identified in Study 1 as affecting team task management decisions, and rather focused on switching between team tasks (and occasionally individual tasks) to ensure that they were contributing equally to both teams’ efforts. Another factor that could have tilted the scales in favor of completing team tasks, even if the participants did not prefer working on a particular team, is the power that social influence has over our attention (e.g., Cialdini & Goldstein, 2004). The impact of social influence could have contributed to the exploratory findings from Study 2.

Although the primary analysis for Study 2 did not provide support for the hypothesized relationships between team factors and team task management behavior or

technology affordances and team task management behavior, exploratory analysis did reveal that participants spent significantly more time on team tasks (in general) than on individual tasks. One possible explanation for this finding is that social influence factors (e.g., Cialdini & Goldstein, 2004) could have affected participants' behaviors in unexpected ways. For example, peer pressure, conformity, or obedience could have influenced individuals to spend more time on team tasks than individual tasks. Social influence seems to be a plausible contributing factor to the observed results given that the aspects of the tasks themselves were controlled across all conditions (i.e., all tasks were of the same structure and difficulty and the same priority was placed on each task).

In summary, my findings indicate that individuals that find themselves at the intersection of multiple teams (which is often the case in today's organizations) plan to spend more time on Cohesive teams than non-Cohesive teams. These findings illustrate the positive impact that Team Cohesion can have on drawing individuals onto teams to complete critical tasks, and keeping them on the team in the face of distractions. However, these findings did not hold in a virtual collaboration environment. In these environments, individuals tend to distribute their time evenly between teams of varying levels of cohesion. One of the most plausible explanations for this change in behavior is that virtual environments change the way in which teams interact, and, therefore, may also change the degree of influence that team Cohesion has over team task management decisions.

There are many examples throughout the Teams literature in which technology changes team behavior in one way or another. For example, Mesmer-Magnus and colleagues (2011) found that team members interacting virtually share more unique

information than do face-to-face teams. However, it is important to point out that all collaboration technologies are not the same. In fact, there is a growing body of literature on “virtual” teams that aims to classify the degree to which technology is used by teams (both in terms of frequency and richness of technology available to team members) so that we can better understand the effects of various types of technology on teams. For example, Kirkman and Mathieu (2005) describe three dimensions of team virtuality: (1) “the extent to which team members use virtual tools to coordinate and execute team processes” (p. 700), (2) “the synchronicity of team member virtual interactions” (p. 700), and (3) “the amount of information value provided by such tools” (p. 700). Although the collaboration technology used in the current study (i.e., Study 2; synchronous chat) would have likely scored on the high-end of the first two dimensions, the third dimension of “amount of information value” was low according to this categorization. Another way to think about the “amount of information value” in a collaboration tool is the richness of the communication that is conveyed to each member, which is fairly low in a chat function that only affords teammates the ability to chat synchronously and review a record of previous communications. Although offering this limited functionality to participants was necessary for experimental control purposes, should other information-rich tools that are readily available to team members in the real world (e.g., video conferencing) been available to participants, the results may have been vastly different. Specifically, with regards to Cohesion, team members may use additional cues from these information-rich technologies (e.g., nonverbal cues) to assess the Cohesion of various teams, which may strengthen the effects of cohesion on team task management as hypothesized.

To further illustrate the complexity of defining modern-day virtual collaboration environments, Gibson and Gibbs (2006) provide a separate taxonomy across the following dimensions: (1) geographic dispersion, (2) electronic dependence, (3) structural dynamism, and (4) national diversity. The importance of understanding factors that are tangentially related to virtualization, such as teams that are distributed globally and across nationalities, and the dynamic shifts in teamwork patterns brought about by technology-mediated collaboration, are also central to the discussion of how teams may be viewed through the lens of technology. Specifically, the authors found that these technology-induced factors hinder innovation, which could possibly be a moderating factor that affected the relationship between team Cohesion and amount of time spent on teams in current study.

Finally, one important collaboration technology-related finding in the current study is that individuals spent half as much time on individual tasks than team tasks when collaborating virtually with their teams. This finding sheds further light on Task Management in MTM work systems in the context of modern-day, highly virtualized environments. There seems to be a powerful pull towards (and inertia to remain on) teams in general when working on tasks in a virtual environment. Furthermore, these effects were seen even with a slight technology manipulation (i.e., making the chat function present or absent), and would possibly be augmented in a real world situation, in which the previously described information-rich collaborative technology tools are ever-present.

#### **4.1 Contribution**

This dissertation extended basic research on task management in overloaded environments to include social and technological aspects of work tasks. Whereas previous task management models focused entirely on characteristics of the tasks themselves that individuals use to decide how they will choose among competing work tasks, this dissertation investigated aspects of teams and technologies that influence these decisions. I identified key characteristics of teams that individuals may consider when deciding how to allocate limited resources across multiple team tasks. Because such social factors have not been accounted for in current models of task management, my first study served to extract the most important team factor related to team task management directly from individuals' decision making choices in constructed scenarios. This novel application of the policy capturing approach allowed me to extract implicit decision making criteria directly from participants' choices rather than relying on survey answers, which can be confounded by participants' faulty metacognition of their decision making processes and often elicit demand characteristics from participants (e.g., answering in a way that would please the experimenter).

Ultimately, in Study 1, I identified the most critical characteristic of teams used by individuals when deciding where to allocate the majority of their time. In Study 2, I further investigated the key team characteristic identified in Study 1 by observing participant behavior in a team task switching laboratory experiment, and uncovered differences in how individuals plan to allocate their time across teams, and how they actually behave in a representative environment. Furthermore, in Study 2, I designed a methodology to investigate how technological affordances may affect the relationship between team characteristics and team task management behavior.

Together, results from the two studies provided insights into the influence of teams and collaboration technologies on employee task management choices. Although I hypothesized that the team characteristic findings in Study 1 would be replicated in Study 2, this was not the case. A possible explanation for these disparate findings would be that the ecology in which participants' managed team tasks in Study 2 influenced their decisions more than they would have believed. Specifically, whereas in Study 1 participants reported how they believe they would allocate their time in various team task management scenarios, in Study 2, their true decisions are evinced by their actual task management behavior. Both of these findings are informative because it is important to know how employees in team-based work systems *plan* to allocate their time versus how they *actually* allocate their time.

## **4.2 Practical Implications**

Understanding how individuals allocate their time across multiple teams is becoming increasingly important in today's work environments. As individuals share their time across multiple teams (e.g., Mortensen et al., 2007) and technologies (e.g., Jaspersen, Carter, & Zmud, 2005), their attention is increasingly pulled in more and more directions, which can lead to inefficiencies in all of the tasks that are being managed (e.g., Katidioti & Taatgen, 2014). However, previous teams research has not caught up to this shift in how team-based work is carried out in a multiple team membership context. Although teams research provides great guidance for improving team performance and enjoyment by changing team states such as Cohesion, it does not address the degree to which these states factor in to an individual's decisions of how to allocate their time across multiple teams. This is a fundamentally different question, which has huge

implications on how grand challenges are carried out in today's most forward-thinking organizations. For example, in extreme work environments, such as NASA astronauts working on the International Space Station (ISS) and planning for a trip to Mars, the ever increasing number of choices that one is faced with when managing their time throughout the day marks a distinct shift in the way work is carried out.

Over the next 15 years, NASA will go through a dramatic shift in the way astronauts carry out their work. Currently, on the ISS, an astronaut's tasks and teams are strictly scheduled. Thus, up until this point, the focus of task switching and task management research has been on the detrimental effects of performance (both on the current task and future task) of forcing an individual to switch from one work task to another. However, on the six-month trip to Mars, there will be long periods of time in which ground control will have very limited communication with astronauts, so strategically scheduling teamwork and taskwork to maximize efficiency and minimize task interference will not be possible. Thus, research will need to focus on how individuals choose between various tasks and teams (some of which will be mission-critical) as they operate in an autonomous work environment. The current research anticipates these changes and addresses the need to understand social aspects of team tasks by investigating the social and technological factors that push and pull astronauts' attention towards (and away from) mission critical tasks. The findings of Study 1 help inform NASA's understanding of the social forces that direct time management in an autonomous crew by demonstrating that Team Cohesion is an important factor (at least in planning out team tasks) to help ensure that critical team tasks are completed. NASA can use this information to equip astronaut with tools that build cohesion before a critical

team task. For example, before executing an Extravehicular Activity (EVA), such as performing routine maintenance outside of the space capsule, astronauts could engage in structured conversations about what has been working well, whether or not anyone needs encouragement or support, and how they can best work together to accomplish their collective goals. Study 1 of the current study provides support for the importance of planned interventions that could serve as preemptive measures to focus the crew's attention back on the team task ahead by amplifying the *affective* component of the *team* task as an alternative to (or in addition to) focusing on attractive aspects of the task itself.

Although not all workplaces are as extreme as space travel, we do see workplaces across disciplines trending towards more agentic work (e.g., Fried, Hollenbeck, Slowik, Tiegs, & Ben-David, 1999; e.g., Arrow, Poole, Henry, Wheelan, & Moreland, 2004). Because team processes and states are constructs that behave similarly across disciplines, the same interventions that apply in extreme environments could also help the student or knowledge worker who is struggling to manage their team tasks in an overloaded environment. For example, if a worker is a member of a team that is struggling to focus on a task, rather than simply focusing on the aspects of the tasks that need to be accomplished, they can create a personal goal to proactively build the team's cohesion or shared understanding of the task, and attack the challenge through the social factors involved in team task management.

Additionally, my exploratory findings in Study 2 indicate that, at least in virtual environments, individuals spend significantly more time on team tasks in general than they do independent tasks, which has important implications from a manager's perspective. Specifically, if an organization manages their tasks largely in a virtual



environment, then managers should assign critical tasks to teams rather than individuals to help ensure that an adequate amount of time is allocated to these tasks.

### **4.3 Directions for Future Research**

The next logical step in this line of research is to gain a more complete picture of the possible relationship between Team Cohesion and Team Task Management behavior. Although the findings for this relationship were insignificant in Study 2 of this dissertation, it may be the case that a relationship exists that could not be captured with two levels of the independent variable (i.e., low cohesion and high cohesion). To determine if this is the case, one could simply replicate the same paradigm used in Study 2, but add a third team that represents a “moderate” level of cohesion to the study. If a non-linear relationship does exist between Team Cohesion and Team Task Management behavior, it could be captured with three data points. This finding would be significant because it would provide behavioral evidence for: (1) the deleterious effects of excessively high team cohesion on team attractiveness, and (2) a disparity between how individuals *think* they will behave in a team task management scenario, and how they *actually* behave.

Next, one could investigate relationships between individual differences and team task management behavior. It may be the case that the large standard deviations in Study 2 reflected differences in how individuals behave based on their personality, propensities to work with others, argentic versus communal behaviors, current teamwork demands or expectations, or other related variables. Identifying systematic differences in the aspects of teams that certain individuals find attractive could be incredibly informative,

especially for organizations like NASA who spend a great deal of effort selecting the right individuals for the job.

Finally, one could create a quasi-experimental version of the Team Task Management design paradigm introduced in Study 2 to identify longitudinal effects of Cohesion as it emerges naturally over time. For example, a study could develop a baseline design in which a single team would work together over a number of weeks and develop strong Cohesion through a series of Cohesion-building activities. Other teams could be introduced and then removed throughout the course of the study, and the time allocated to the cohesive team could be measured before and after these critical points. At one or more points in the baseline study, the cohesive team could be removed, leaving only one member to switch between the remaining low Cohesion teams, and the resulting time allocation behaviors could be compared to the previous transition points. One important note for this design is that other team processes and states are likely to naturally co-evolve with cohesion (e.g., a stronger Shared Mental Model of teamwork and taskwork aspects of team tasks), which would have to be controlled for (probably through post-hoc statistical analysis of the partial variance attributed to those characteristics). However, this approach would address the previously discussed concerns of construct validity in that the participant will help shape the cohesive nature of the team, rather than trying to imagine what it would be like to work with them.

#### **4.4 Conclusion**

This program of research was the first to develop a design paradigm for investigating social and technological aspects of team task management in a time when teams and technologies are steadily becoming more and more prevalent. Furthermore,

findings from each of the two studies provide a glimpse into the social factors that push and pull our attention as we struggle to manage our time in an age when time is becoming a scarce commodity. Some evidence points to Team Cohesion as an especially important social factor, both in terms of drawing individuals' attention in to a team task and keeping them on that task. Other findings suggest that, in virtual work environments, individuals are likely to spend roughly twice as much time on any team task as they would on an individual task. Although there are still many limitations to work through and theoretical knots to untangle, this research lays the foundation for bridging the gap between different psychological disciplines to address a gap in the growing body of research on task management – the impact of social and technological factors on task management. This research also draws from the decision-making literature to describe basic cognitive processes involved in choosing between tasks in this increasingly complex environment. Furthermore, it provides a paradigm for understanding the differential effects of top-down and bottom-up influences on behavior. These findings and novel methodologies will help future researchers better understand the true impact of having more choices, both in terms of who individuals will work with and how they will carry out that work, on time management behaviors.

## APPENDIX A. SURVIVAL TASKS USED IN TEAM TASK

### SWITCHING TRIALS

*Six survival tasks (along with associated survival items) used in each of the trials in the team task switching laboratory study (Study 2)*

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#### Survival Task 1: Jamestown disease

**Scenario:** You are one of the survivors of a terrible disease that swept Jamestown, Virginia after a series of severe weather episodes. Your team has to stick together, and you can assume the items are in good condition unless otherwise stated. The goal is to pack items that will best help you survive and aid in being rescued.

**Items:**

A piece of flint (a hard gray stone) and a striker (a small piece of steel)

Salted pork and a hard tack

A nonflammable candlestick holder

A gun

A sword

An Ax

Medicine

Beads (glass trinkets or jewelry)

Coins

A hemp rope (15 meters/50 feet)

A tool to measure the altitude of the Sun

A magnetic compass

A jar

A bottle

A hammock

With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know how much you will be able to carry. When the time comes, your list of rankings will be used to determine which items will be taken once you know how many items the transport can accommodate. Size of item does not factor into how many can ultimately be taken. A compass counts the same as a sword.

Item	Ranking
A piece of flint (a hard gray stone) and a striker (a small piece of steel)	
Salted pork and a hard tack	
A nonflammable candlestick holder	
A gun	
A sword	
An Ax	
Medicine	
Beads (glass trinkets or jewelry)	
Coins	
A hemp rope (15 meters/50 feet)	
A tool to measure the altitude of the Sun	
A magnetic compass	
A jar	
A bottle	
A hammock	

### Survival Task 2: Alaskan wilderness

**Scenario:** Your team is going to be dropped off in the Alaskan wilderness. Your team has to stick together, and you can assume the items you have are in good condition unless otherwise stated. The goal is to pack items that will best help you survive and aid in being rescued.

**Items:**

Compress kit (with 28 ft. of 2-inch gauze)  
Cigarette lighter without the fluid  
Newspaper (one per person)  
Two ski poles  
Sectional air map made of plastic  
Family-sized chocolate bar (one per person)  
Quart of 85-proof whiskey  
Can of shortening  
Ball of steel wool  
Loaded .45-caliber pistol  
Compass  
Knife  
30 feet of rope  
Flashlight with batteries  
Extra shirt and pants for each survivor

With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know what transport will be available. When the time comes, your list of rankings will be used to determine which items will be taken once you know how many items the transport can accommodate. Size of item does not factor into how many can ultimately be taken. A compass counts the same as a sleeping bag.

Item	Ranking
Compress kit (with 28 ft. of 2-inch gauze)	
Cigarette lighter without the fluid	
Newspaper (one per person)	
Two ski poles	

Sectional air map made of plastic	
Family-sized chocolate bar (one per person)	
Quart of 85-proof whiskey	
Can of shortening	
Ball of steel wool	
Loaded .45-caliber pistol	
Compass	
Knife	
30 feet of rope	
Flashlight with batteries	
Extra shirt and pants for each survivor	

### Survival Task 3: Canadian plane crash

**Scenario:** You and your companions have just survived the crash of a small plane Northern Canada where the temperature is well below freezing and there is snow on the ground. Your team has to stick together, and you can assume the items you have are in good condition unless otherwise stated. The goal is to pack items that will best help you survive and aid in being rescued.

**Items:**

A ball of steel wool  
A small ax  
A loaded .45-caliber pistol  
Can of Crisco shortening  
Newspapers (one per person)  
Cigarette lighter (without extra fluid)  
Extra shirt and pants for each survivor  
20 x 20 ft. piece of heavy-duty canvas

A sectional air map made of plastic  
 One quart of 100-proof whiskey  
 A compass  
 Family-size chocolate bars (one per person)  
 Blanket  
 Water filter  
 Flashlight

With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know how many items you will be able to carry. When the time comes, your list of rankings will be used to determine which items you are able to bring in this situation. Size of item does not factor into how many can ultimately be taken. A whistle counts the same as a tarp.

Item	Ranking
A ball of steel wool	
A small ax	
A loaded .45-caliber pistol	
Can of Crisco shortening	
Newspapers (one per person)	
Cigarette lighter (without fluid)	
Extra shirt and pants for each survivor	
20 x 20 ft. piece of heavy-duty canvas	
A sectional air map made of plastic	
One quart of 100-proof whiskey	
A compass	
Family-size chocolate bars (one per person)	
Blanket	
Water Filter	
Flashlight	



#### Survival Task 4: Moon survival

**Scenario:** Your team is going to be dropped off on the surface of the moon. Your team has to stick together, and you can assume the items you have are in good condition unless otherwise stated. The goal is to pack items that will best help you survive.

**Items:**

Box of matches  
Food concentrate  
50 feet of nylon rope  
Parachute silk  
Portable heating unit  
Two .45 caliber pistols  
One case of dehydrated milk  
Two 100 lb. tanks of oxygen  
Stellar map  
Self-inflating life raft  
Magnetic compass  
5 gallons of water  
Signal flares  
First aid kit, including injection needle  
Solar-powered FM receiver-transmitter

With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know what transport will be available. When the time comes, your list of rankings will be used to determine which items will be taken once you know how many items the transport can accommodate. Size of item does not factor into how many can ultimately be taken. A compass counts the same as an oxygen tank.

Item	Ranking
Box of matches	
Food concentrate	

50 feet of nylon rope	
Parachute silk	
Portable heating unit	
Two .45 caliber pistols	
One case of dehydrated milk	
Two 100 lb. tanks of oxygen	
Stellar map	
Self-inflating life raft	
Magnetic compass	
5 gallons of water	
Signal flares	
First aid kit, including injection needle	
Solar-powered FM receiver-transmitter	

### Survival Task 5: Colorado hiking

**Scenario:** You take a trip to Colorado to hike some mountains with a group of people, and one of the hikers slips on some loose rocks, falls down a steep slope and severely injures her ankle. Your team has to stick together, and you can assume the items you have are in good condition unless otherwise stated. The goal is to pack items that will best help you survive and aid in being rescued.

**Items:**

Tarp  
First aid kit  
Flashlight  
Whistle  
Garbage bag

Matches, flint  
 Steel wool  
 Compass  
 Map  
 Extra clothing  
 Metal can  
 Pocket knife  
 Reflective device  
 Bandana  
 Energy bar

With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know how many items you will be able to carry. When the time comes, your list of rankings will be used to determine which items you are able to bring in this situation. Size of item does not factor into how many can ultimately be taken. A compass counts the same as a large sheet canvas.

Item	Ranking
Tarp	
First aid kit	
Flashlight	
Whistle	
Garbage bag	
Matches, flint	
Steel wool	
Compass	
Map	
Extra clothing	
Metal can	
Pocket knife	

Reflective device	
Bandana	
Energy bar	

### Survival Task 6: Desert survival

**Scenario:** You are going to be dropped off 100 miles from the coast in the Sahara Desert. Your team has to stick together, and the items are in good condition unless otherwise stated. The goal is to pack items that will best help you to survive, and aid in being rescued.

**Items:**

Flashlight (4 battery size)  
 Jackknife  
 Sectional air map of the area  
 Plastic raincoat (large size)  
 Magnetic Compass  
 Compress kit with gauze  
 .45 caliber pistol (loaded)  
 Parachute (red & white)  
 Bottle of 1,000 salt tablets  
 1 quart of water per person  
 Book (Edible Animals of the Desert)  
 A pair of sunglasses per person  
 2 quarts of 80 proof Vodka  
 1 top coat per person  
 A cosmetic mirror

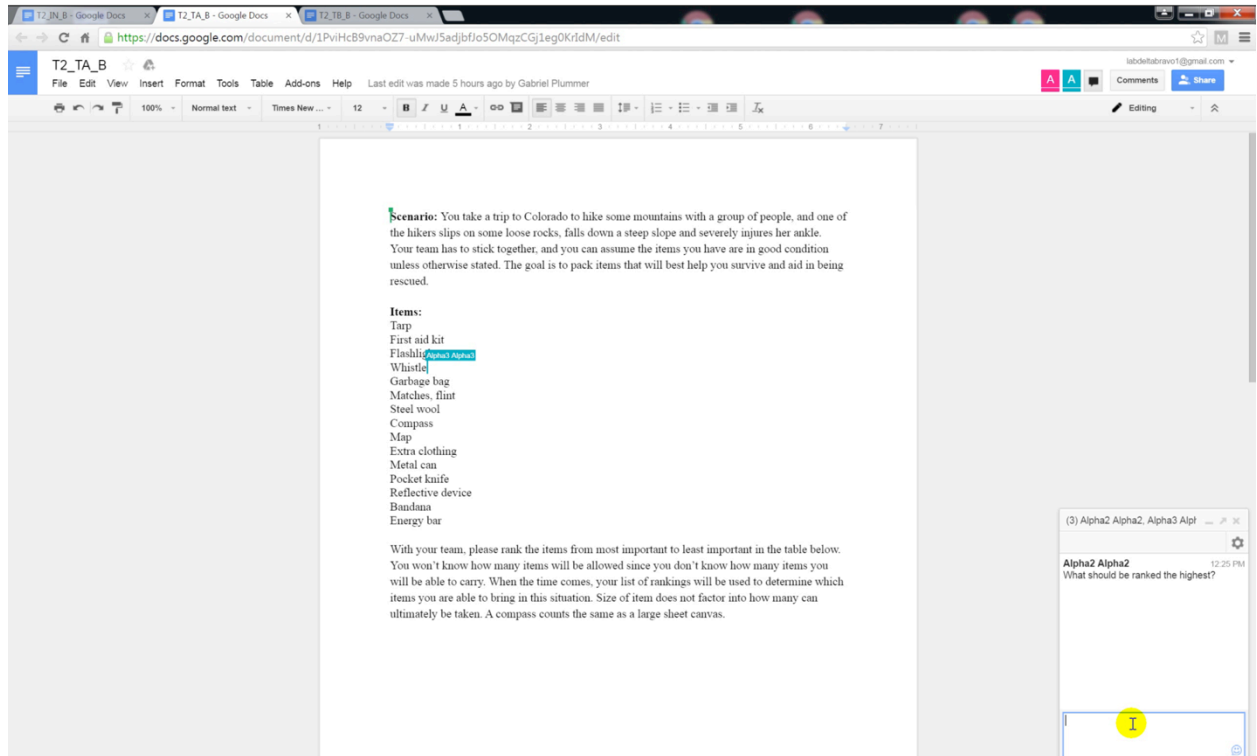
With your team, please rank the items from most important to least important in the table below. You won't know how many items will be allowed since you don't know if/what

transport will be available. When the time comes, your list of rankings will be used to determine which items will be taken once you know how many items the transport can accommodate. Size of item does not factor into how many can ultimately be taken. A knife counts the same as a parachute.

Item	Team Ranking
Flashlight (4 battery size)	
Jackknife	
Sectional air map of the area	
Plastic raincoat (large size)	
Magnetic Compass	
Compress kit with gauze	
.45 caliber pistol (loaded)	
Parachute (red & white)	
Bottle of 1,000 salt tablets	
1 quart of water per person	
Book (Edible Animals of the Desert)	
A pair of sunglasses per person	
2 quarts of 80 proof Vodka	
1 top coat per person	
A cosmetic mirror	

## APPENDIX B. SYNCHRONOUS COMMUNICATION TOOL IMAGE

*Screen shot of a Google Doc with chat function enabled.*



*Note:* A Google Doc is “a word processor...[that is] part of a free, web-based software office suite offered by Google within its Google Drive service. The suite allows users to create and edit documents online while collaborating with other users in real-time” (Wikipedia, 2016). As described on Google’s website, Google Docs is described as “Word processing for teams” (Google, 2016) and allows individuals and teams to “Create and edit text documents right in your browser—no dedicated software required. Multiple people can work at the same time, and every change is saved automatically.” (Google, 2016).

## APPENDIX C. NEUTRAL STATEMENTS USED IN STUDY 2

*Neutral” statements used by experimenters when interacting with participants in the laboratory team task switching study (Study 2)*

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### **RESPONSES**

#### ***General responses - agreement***

That sounds OK to me.

That works.

I'm fine with that.

Oh, great.

#### ***General responses - disagreement***

Let's keep thinking about that one.

That may be a little high.

That may be a little low.

I'm not sure that works for this situation.

#### ***General responses - indifference***

I'm not sure.

I could go either way.

#### ***Item-specific response***

[Item] would work best I think.

[item] doesn't really work here.

[item] seems to be better here.

[item] should be higher on the list.

### **QUESTIONS (choose 4 total)**

### ***General Questions***

What should be ranked the highest?

What should be ranked the lowest?

Should we move to the next one?

Any thoughts on what we already have?

Any thoughts on which one to do next?

What would be important in this situation?

### ***Item-specific Questions***

Where should [item] go?

What do you think about [item] as #[#]?

What should be ranked the highest?

What should be ranked the lowest?

Does anyone know what [item] does?

## **ITEMS AND TEAM MEMBERS**

### ***Items from Task T1A***

Compress kit (with 28 ft. of 2-inch gauze)

Cigarette lighter without the fluid

Newspaper (one per person)

Two ski poles

Sectional air map made of plastic

Family-sized chocolate bar (one per person)

Quart of 85-proof whiskey

Can of shortening

Ball of steel wool



Loaded .45-caliber pistol

Compass

Knife

30 feet of rope

Flashlight with batteries

Extra shirt and pants for each survivor

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## APPENDIX D. TRANSCRIPT EXCERPT FROM STUDY 2

*Example of a transcript from a chat log taken during a single trial of the laboratory team task switching study (Study 2)*

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### High Cohesion Team

<u>Person commenting</u>	<u>Comment made [or ranking entered for an item]</u>
Cohesive Team Member 1:	<i>1 [enters ranking next to “Flashlight with batteries” item]</i>
Cohesive Team Member 1:	<i>What should be ranked the lowest?</i>
Participant:	<i>lighter w/o fluid?</i>
Cohesive Team Member 2:	<i>I’m fine with that</i>
Participant:	<i>15 [enters ranking next to “Cigarette lighter without fluid” item]</i>
Cohesive Team Member 2:	<i>3 [enters ranking next to “Quart of 85-proof whiskey” item]</i>
Cohesive Team Member 1:	<i>2 [enters ranking next to “Knife” item]</i>
Cohesive Team Member 2:	<i>I think we are doing an awesome job!</i>
Cohesive Team Member 2:	<i>Does anyone know what the air map does?</i>
Cohesive Team Member 1:	<i>4 [enters ranking next to “Family-sized chocolate bar” item]</i>
Participant:	<i>Helps navigate I assume?</i>
Cohesive Team Member 2:	<i>Oh, great</i>
Cohesive Team Member 1:	<i>Go team!</i>

Participant: 5 *[enters ranking next to “Sectional air map” item]*

Participant: *what about the compass?*

Participant: 6? *[enters ranking next to “Compass” item]*

Cohesive Team Member 2: *That sounds great, let's do that!*

Participant: 7? *[enters ranking next to “Two ski poles” item]*

Participant: 8? *[enters ranking next to “30 feet of rope” item]*

Cohesive Team Member 2: *that works*

Cohesive Team Member 1: *I like how we are working together so well.*

Participant: *im just gonna suggest things??*

Participant: *does that work? feel free to change whatever!*

Cohesive Team Member 1: *I'm fine with that.*

Cohesive Team Member 2: *We're definitely the best team.*

Cohesive Team Member 1: *We are going to ace this thing!*

Participant: 11? *[enters ranking next to “Extra shirt and pants” item]*

Participant: 12 *[enters ranking next to “Ball of steel wool” item]*

Participant: 13 *[enters ranking next to “Newspaper (one per person)” item]*

Participant: 14 *[enters ranking next to “Can of shortening” item]*

Cohesive Team Member 1: *We're going to make it!*

Participant: *woo hoo*

Cohesive Team Member 2: *Let's stick together on this and get it done.*

Participant: *what else would you want to change?*

---

Low Cohesion Team

Person commenting      Comment made [or ranking entered for an item]

Cohesive Team Member 2: *There's no way we are going to finish this.*

Participant: *I think we can*

Participant: *I would say water, food, weapons, shelter?*

Cohesive Team Member 1: *That works*

Cohesive Team Member 1: *1 [enters ranking next to "Water bottle" item]*

Cohesive Team Member 2: *2 [enters ranking next to "A 3 lb. wheel of cheddar cheese" item]*

Cohesive Team Member 1: *I really don't like this.*

Cohesive Team Member 2: *3 [enters ranking next to "Bows and arrows" item]*

Cohesive Team Member 1: *4 [enters ranking next to "Airplane blankets" item]*

Participant: *5? [enters ranking next to "Flint and steel" item]*

Participant: *flint lights fire*

Cohesive Team Member 2: *That may be a little high.*

Cohesive Team Member 2: *6? [enters ranking next to "Signal flare" item]*

Cohesive Team Member 1: *I don't really like working with y'all very much.*

Participant: *i'm sorry to hear that*

Participant: *what do you think of the sleeping bags?*

Cohesive Team Member 1: *I have to go work with another team.*

Cohesive Team Member 2: *7?*

Cohesive Team Member 2: *This is taking forever... it's miserable.*

Participant: *7 [enters ranking next to "One very insulated sleeping bag" item]*

Participant: *works for me*

Cohesive Team Member 2: *I think we are going to fail miserably at this task.*

Participant: *[removes question mark after 5 next to "Flint and steel" item]*

Participant: *compass? 8?*

Cohesive Team Member 1: *I don't think we are doing well at all on this task.*

Participant: *peanuts 9?*

Participant: *bows and arrows?*

Cohesive Team Member 2: *No, that doesn't sound good to me at all.*

Cohesive Team Member 2: *What do you think about the Bow and arrows as 8?*

Participant: *great*

Participant: *what do u prefer at 3 instead?*

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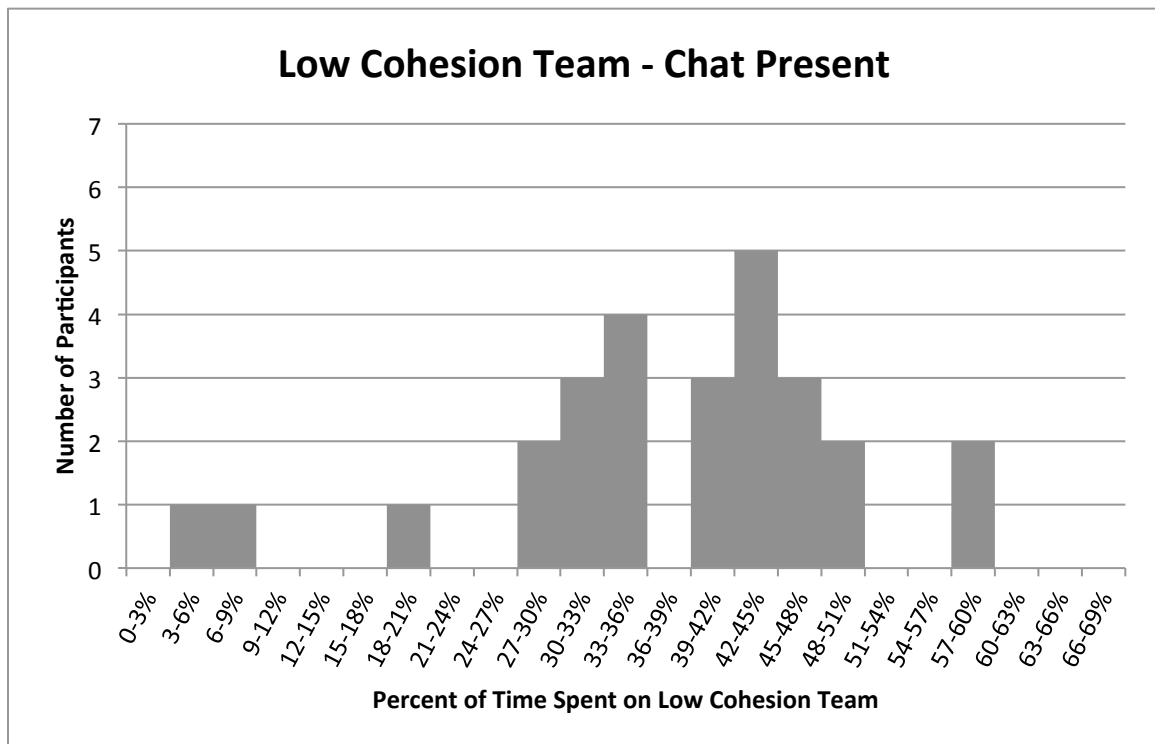
*Note:* This is the chat log of a single participant interacting with two teams, a High Cohesion Team and a Low Cohesion Team, throughout a single trial of the study. This is a trial in which the chat function was enabled. The "Team Members" in the chat log are experimenters serving as confederate team members. Although I separate the transcripts from the two teams into "High Cohesion Team" and "Low Cohesion Team" to make the

transcripts easier to follow, the participant was, in fact, switching between the two teams throughout the trial, so the comments made to either team were interspersed.

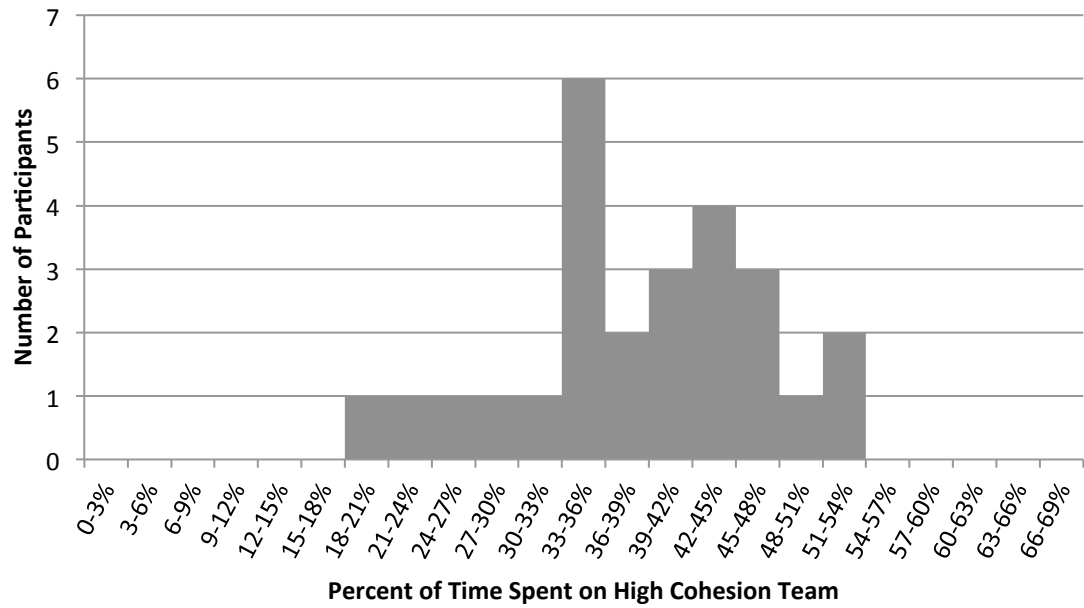
## APPENDIX E. HISTOGRAMS OF DATA FROM STUDY 2

*Histograms of data in each conditions of Study 2.*

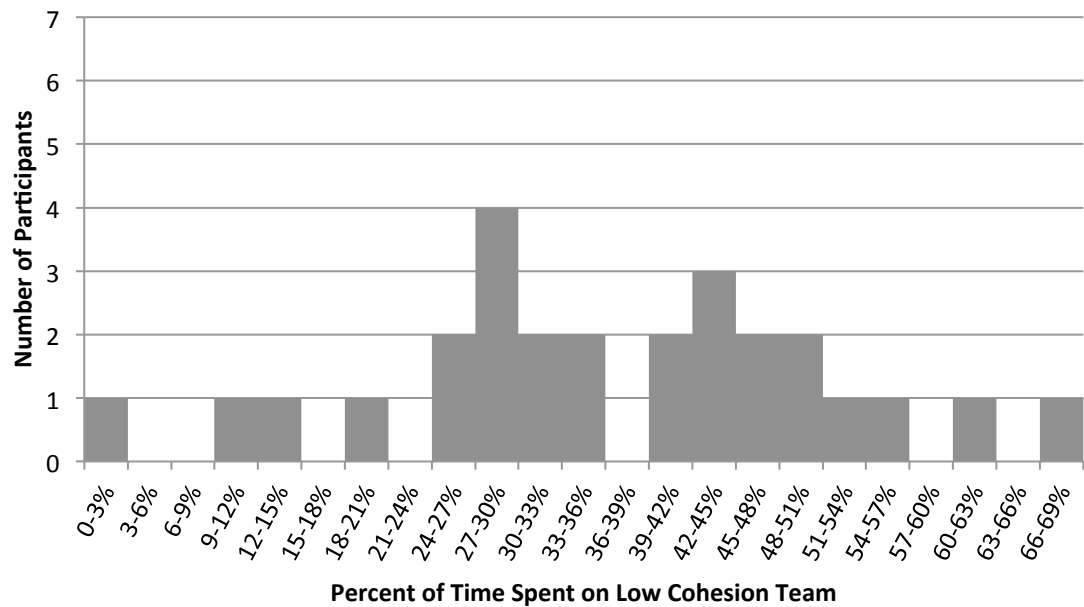
*Note:* Data in the “High Cohesion Team – Chat Absent” condition were found to violate the Assumption of Normality (Shapiro Wilk test;  $p < 0.001$ ) required to be confident in results of an ANOVA test. Therefore, nonparametric tests were used to analyze the data. Data in all other conditions of Study 1 were found to be normally distributed.



**High Cohesion Team - Chat Present**

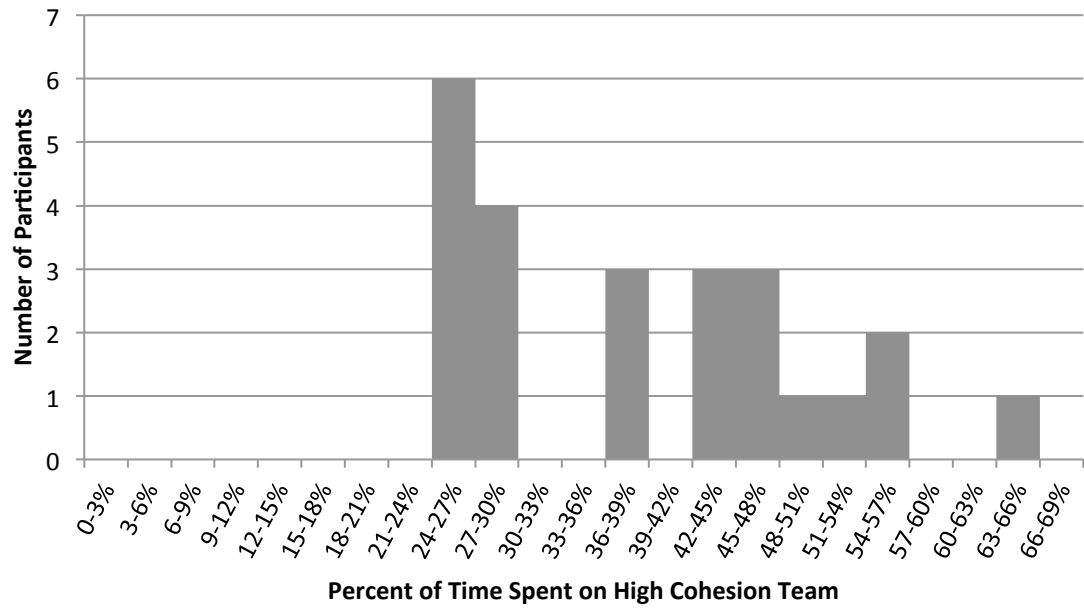


**Low Cohesion Team - Chat Absent**

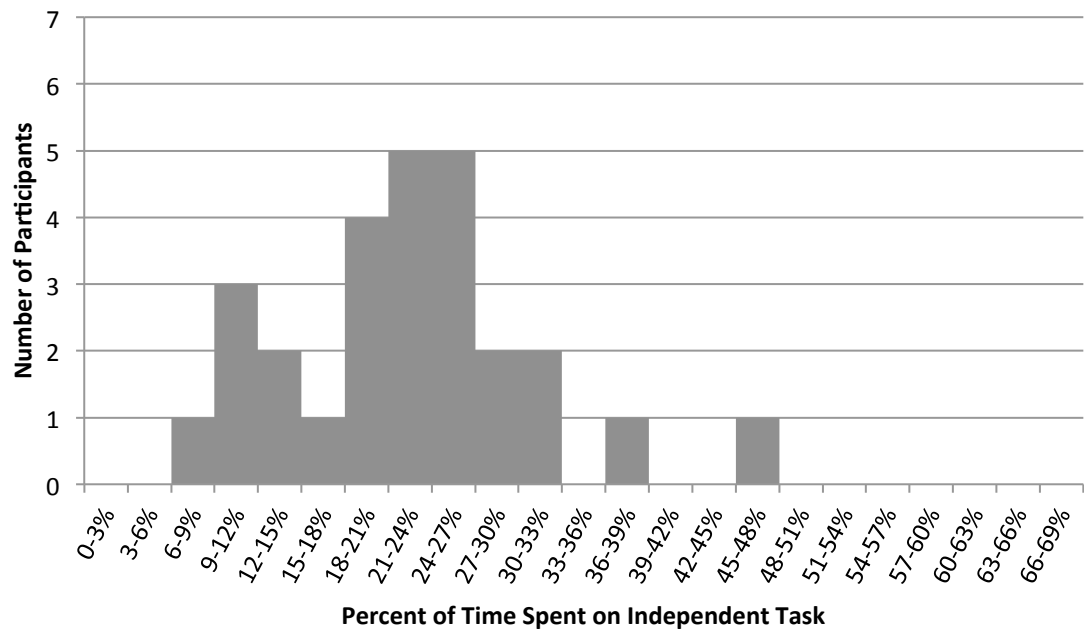


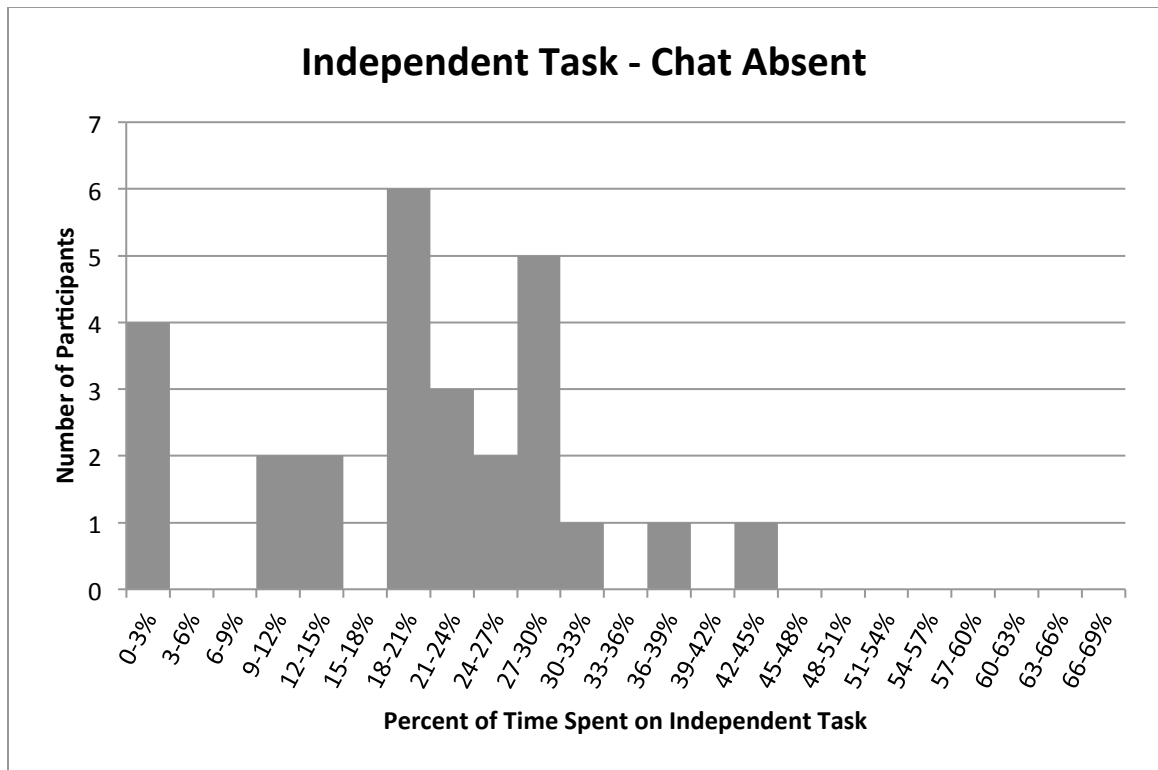


### High Cohesion Team - Chat Absent



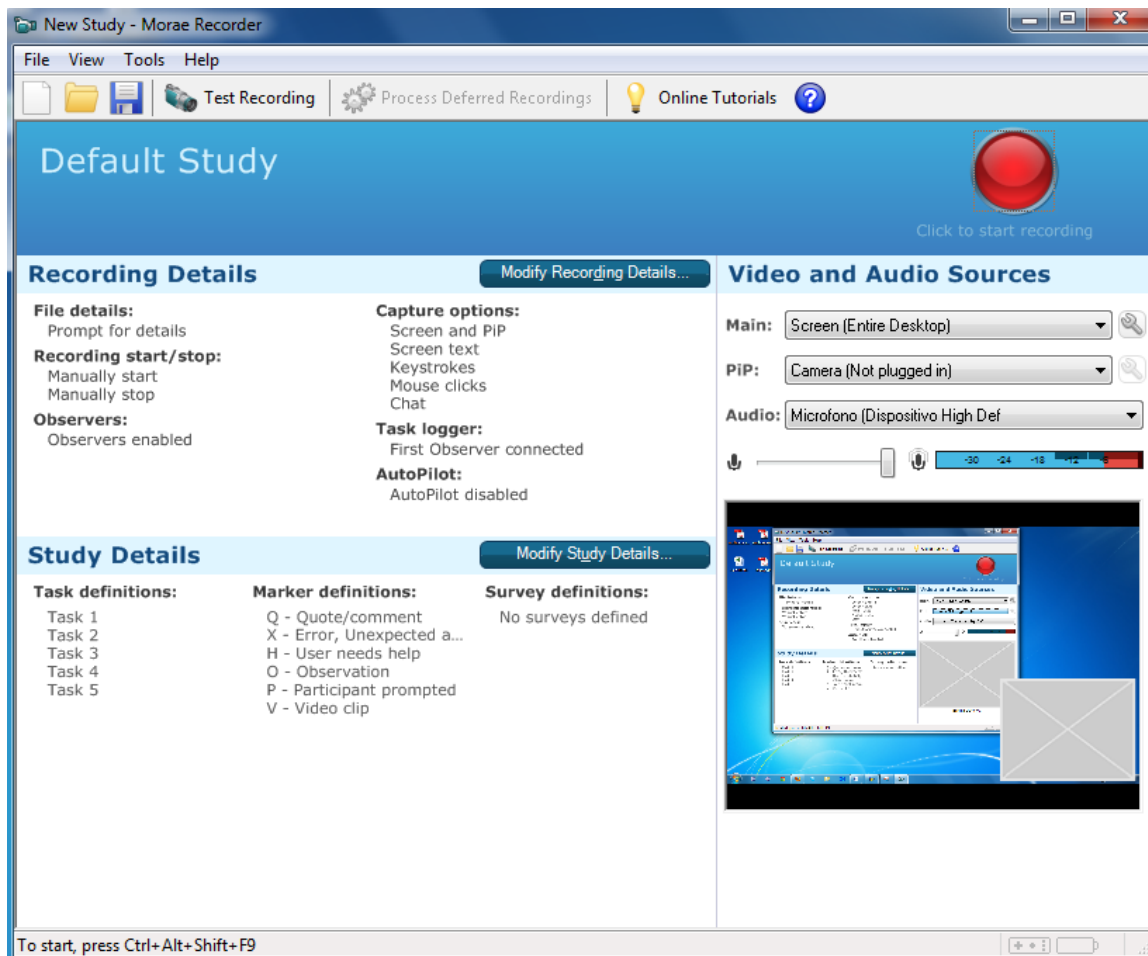
### Independent Task - Chat Present





## APPENDIX F. IMAGES OF SCREEN RECORDING SOFTWARE

*Sample images of (1) Morae Recorder software program used to record task switching data during the Team Task Switching laboratory study (Study 2), and (2) an example of the time stamped activity log provided by Morae.*

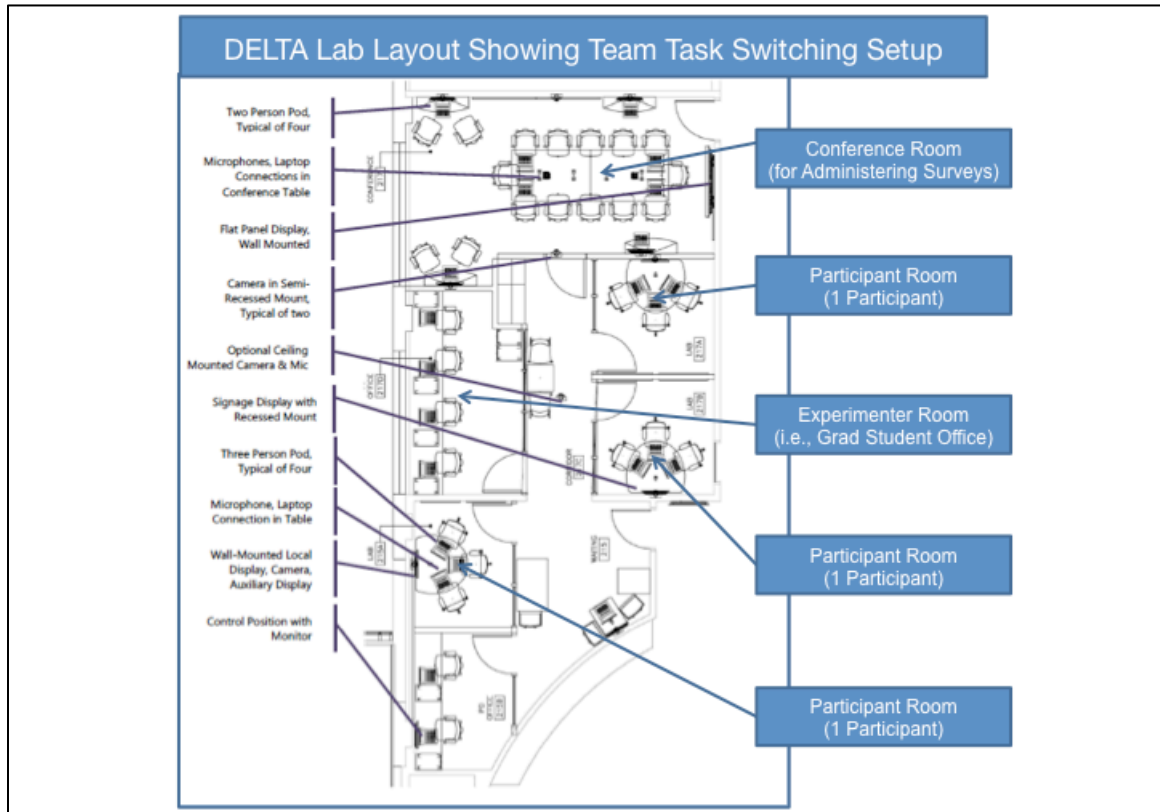


Elapsed Time	Recording	Task	Event	Details	Application	Owner	Notes	Title	Score
00:16.4	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
00:18.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
00:19.2	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_IN_A - Google Docs	
00:29.7	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
00:55.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
01:34.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
02:29.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
03:06.8	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
03:48.4	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
05:30.9	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
06:19.9	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_IN_A - Google Docs	
06:20.5	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
06:23.5	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
06:26.8	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_IN_A - Google Docs	
07:32.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
07:32.9	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
07:45.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
07:59.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
08:02.3	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_IN_A - Google Docs	
08:36.7	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TA_A - Google Docs	
08:37.9	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T1_TB_A - Google Docs	
09:46.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TA_A - Google Docs	
09:48.4	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TB_A - Google Docs	
09:50.9	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_IN_A - Google Docs	
10:20.1	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TA_A - Google Docs	
10:36.7	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TB_A - Google Docs	
11:00.3	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TA_A - Google Docs	
12:13.2	Participant125_Part2_06.1	(Tab) Web P	https://docs.	chrome.exe				T2_TA_A - Google Docs	

*Note:* The top image depicts the Morae Recorder software used to program recording requirements for each session. This interface was visible only to experimenters. Morae ran in the background on the participant computers, so nothing on the participants' interfaces indicated that the Morae software was active. They simply interacted with the software tools (i.e., Google Docs) that were used to carry out the tasks with their teams while Morae recorded their actions. The bottom image depicts an example of the output provided by the Morae recorder. Important columns to note are the ones labeled "Elapsed Time" (far left), which indicates the time stamp with millisecond temporal resolution, and "Title" (second column from the right), which indicates the task to which the individual switched at the associated Elapsed Time. For example, the first visible row captured in this particular screen shot indicates that the participant switched to task T1\_TA\_A (team A's task during the first trial of the session) 16.4 seconds into the trial.

## APPENDIX G. SCHEMATIC OF DELTA EXPERIMENTAL LAB

*Schematic of the DELTA lab at the Georgia Institute of Technology in which the Team Task Switching laboratory study (Study 2) took place.*



*Note:* Each participant completed tasks in their own participant room, and interacted with the experimenters (who served as team members), who were sitting in the graduate student office, over computers. Surveys were administered in the Conference Room.

## APPENDIX H. TABLE OF HYPOTHESES AND TESTING

### APPROACHES

The analytical methods utilized in Study 1 and Study 2 differed in terms of measures used to identify the effect of team characteristics on team task management behavior. Each study provided unique information that informed our understanding of team task management. Furthermore, Study 2 explored technology factors that influenced team task management. The table below summarizes how each of the proposed hypotheses was investigated in Study 1 and Study 2 (if applicable).

Hypothesis	Study 1: <i>Policy Capturing</i>	Study 2: <i>Lab Experiment</i>
<i>Hypothesis 1. Team cohesion is positively related to team task stickiness.</i>	Team cohesion of the current team was manipulated and the decision to remain on the current team's task was measured.	Study 1 indicated that team cohesion of the current team was the most influential predictor of team task time allocation for a significant majority of participants, so this team characteristic was the focus of Study 2. Team cohesion of the teams was manipulated and the percentage of time spent on each team's task was measured via behavioral observations of participants' team task switching behavior.
<i>Hypothesis 2. Team affect has an inverted-U relationship with team task attractiveness, such that low team affect is not attractive, moderate team affect is highly attractive, and high team affect is not attractive.</i>	Team cohesion of the alternative team was manipulated and the decision to switch to the alternative team's task was measured.	Study 1 indicated that team cohesion of the alternative team was an influential predictor of team task time allocation for a significant majority of participants, so this team characteristic was the focus of Study 2. Team cohesion of the teams was manipulated and the percentage of time spent on each team's task was measured via behavioral observations of participants' team task switching behavior.

<i>Hypothesis 3a. Team behavioral processes are positively related to team task stickiness.</i>	Team coordination of the current team was manipulated and the decision to remain on the current team's task was measured.	Team coordination was not found to be the most influential team factor in Study 1, so it were not manipulated in Study 2.
<i>Hypothesis 3b. Team behavioral processes are positively related to team task attractiveness.</i>	Team coordination of the alternative team was manipulated and the decision to switch to the alternative team's task was measured.	Team coordination was not found to be the most influential team factor in Study 1, so it were not manipulated in Study 2.
<i>Hypothesis 4a. Team SMM is positively related to team task stickiness.</i>	Team SMM of the current team was manipulated and the decision to remain on the current team's task was measured.	Team SMM was not found to be the most influential team factor in Study 1, so it was not manipulated in Study 2.
<i>Hypothesis 4b. Team cognition is positively related team task attractiveness.</i>	Team SMM of the alternative team was manipulated and the decision to remain on the current team's task was measured.	Team SMM was not found to be the most influential team factor in Study 1, so it was not manipulated in Study 2.
<i>Hypothesis 5a. Persistent person-to-person association affordances strengthen the relationship between team affective states and team stickiness.</i>	Persistent person-to-person association affordances of the current team's technology were not studied in Study 1.	Results of Study 1 indicated that team cohesion was the most influential factor of team task time allocation for a significant majority of participants, so the Person-to-person association affordance of the team's technology was manipulated (and crossed with the team affect manipulation), and the percentage of time spent the current team's task while subjected to interruptions by the alternative team was measured via behavioral observations of participants' team task switching behavior.
<i>Hypothesis 5b. Persistent person-to-person association affordances change the relationship between team</i>	Persistent person-to-person association affordances of the alternative team's technology were not studied in Study 1.	Results of Study 1 indicated that team cohesion was the most influential factor of team task time allocation for a

<i>affective states and team attractiveness from an inverted-U function to a positive relationship.</i>		significant majority of participants, so the Person-to-person association affordance of the team's technology was manipulated (and crossed with the team affect manipulation), and the percentage of time spent the current team's task while subjected to interruptions by the alternative team was measured via behavioral observations of participants' team task switching behavior.
<i>Hypothesis 6a. Editability affordances strengthen the positive relationship between team behavioral processes and team task stickiness.</i>	Editability affordances of the current team's technology were not studied in Study 1.	Results of Study 1 did not indicate that team coordination was a significant predictor of team task time allocation for a significant majority of participants, so Editability affordances were not manipulated in Study 2.
<i>Hypothesis 6b. Editability affordances strengthen the positive relationship between team behavioral processes and team task attractiveness.</i>	Editability affordances of the alternative team's technology were not studied in Study 1.	Results of Study 1 did not indicate that team coordination was a significant predictor of team task time allocation for a significant majority of participants, so Editability affordances were not manipulated in Study 2.
<i>Hypothesis 7a. Person-to-information association affordances strengthen the positive relationship between team cognition and team task stickiness.</i>	Person-to-information affordances of the current team's technology were not studied in Study 1.	Results of Study 1 did not indicate that team SMM was a significant predictor of team task time allocation for a significant majority of participants, so Persistence and person-to-information affordances were not manipulated in Study 2.
<i>Hypothesis 7b. Person-to-information association affordances strengthen the</i>	Person-to-information affordances of the alternative team's technology were not	Results of Study 1 did not indicate that team SMM was a significant predictor of team



<i>positive relationship between team cognition and team task attractiveness.</i>	studied in Study 1.	task time allocation for a significant majority of participants, so Persistence and person-to-information affordances were not manipulated in Study 2.
<i>Hypothesis 8: The level of Cohesion within a particular team is positively related to the amount of time that an individual will allocate to that team.</i>	Amount of time allocated to teams was not measured in Study 1.	Results of Study 2 indicated that team Cohesion did not affect the amount of time allocated across teams in a team task switching situation.
<i>Hypothesis 9: Persistent person-to-person association affordances strengthen the relationship between team Cohesion and the amount of time that an individual will allocate to that team.</i>	Amount of time allocated to teams was not measured in Study 1.	Results of Study 2 indicated that team persistent person-to-person association affordances did not affect the relationship between team Cohesion and amount of time allocated across teams in a team task switching situation.

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